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The relationship of public high school performance to expenditure per pupil and high school size was examined. Data from 775 public high schools in the continental United States generated by the American Institute for Research (Project Talent) was used to evaluate twelve potential measures of high school performance. Nine of these measures were either achievement tests or factor scores based on all tests. What were judged to be the most important of these output measures were then related to high school expenditure and size in a simple model of the educational process in which performance of pupils from similar socio-economic backgrounds was explained by a general intelligence factor score, school expenditure, school size, and an index of pupil socio-economic background. (RLP)

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HIGH SCHOOL SIZE AND COST FACTORS

March, 1968

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education
Bureau of Research

Final Report

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Herbert J. Kiesling

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Bloomington, Indiana

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PREFACE AND ACKNOWLEDGMENTS

In the early 1950's James Flanigan and others at the University of Pittsburgh conceived the idea of making a nation-wide survey of high school students, their schools, and their social backgrounds. With financing from the U. S. Office of Education, this idea culminated in the well-known Project Talent study of high school pupils and performance.

Flanigan was not an economist and the Project Talent data were not particularly collected from a point of view of economists, a fact which, in the opinion of the present author, is unfortunate. Even so, however, there was a great deal of information assembled in the Talent study which could be useful to economic analysis.

The possibilities for the present study were perceived by the author in 1963 and 1964 when he performed a similar exercise with a sample of New York school districts as part of the requirements for his doctorate in economics at Harvard. The project has been financed by the U. S. Office of Education and was conducted over a 16-month period beginning in September, 1966.

Perhaps the author's greatest debt of gratitude is to the U. S. Office of Education for financing the project in the first place. In addition, three Project Talent people were extremely helpful. Dr. Lyle Schoenfeldt and Mrs. Mary Kay Garee were most helpful in doing the work involved in getting the rather considerable volume of data from Project Talent data tapes to the author's data tapes. Dr. William Cooley, the Project Director at the time these data were being obtained, gave friendly support and counsel. Greatest thanks must go to Professor Richard L. Turner, an educational psychologist in the Indiana University School of Education, without whose help the manuscript as it now stands would not have been possible. Even so, the author found himself dangerously outside his own area of competence on some of the pages that follow and therefore reserves (and deserves) responsibility for any errors of interpretation that the more competent reader may find there.

Thanks also go to the assistants who worked on the project. These include Ronald Bond, Linda Bohren, H. James Brown, and Theodosius Roussos. Some mention should also be made of the full support and cooperation of the Research Computing Center at Indiana University. In designing the project, the author asked for funds to pay for (what he thought was) the large total of eight hours of computer time. The project used in excess of one hundred hours on one of the fastest machines now commercially available. Much of the remaining time was generously contributed by the I. U. Research Computing Center in what is tantamount to a large element of profit sharing which did not show up in the contract.

Finally, investigators who use Project Talent material are asked to include the following statement.

> This investigation utilized the Project TALENT Data Bank, a cooperative effort of the U.S. Office of Education, the University of Pittsburgh, and the American Institutes for Research. The design and interpretation of the research reported herein, however, are solely the responsibility of the author.

Herbert J. Kiesling

Bloomington, Indiana
February, 1968

SUMMARY

This is a study of the relationship of public high school performance to expenditure per pupil and high school size. The data used were generated by the American Institute for Research (Project Talent) for 775 public high schools in the continental United States. An attempt was made to evaluate 12 potential measures of high school performance. Nine of these were either achievement tests or factor scores based on all tests. The remaining three were constructed to measure the breadth of curriculum and facilities. What were judged to be the most important of these output measures were than related to high school expenditure and size in a simple model of the educational process in which performance of pupils from similar socio-economic backgrounds is explained by a general intelligence factor score, school expenditure, school size, and an index of pupil socio-economic background.

When all the public high schools were considered together, it was found that expenditure was significantly related to performance with $100 of expenditure typically being associated with between one and two tenths of a standard deviation of the output variable. Also for all high schools, it was found that increased size was negatively related to most measures of performance. With respect to pupils from different home environments, it was found that school expenditure is related more consistently to the performance of children from better socio-economic environments.

The study also analyzes in great detail the differences in the performance of the variables in the model relative to regional and urbanness differences. The results for within groups of high schools cross-classified by both region and urbanness was that there seemed to be little relationship of expenditure and size to performance. At a slightly higher level of aggregation, however, relationships similar to those for all schools taken together were often found for all northern and western high schools and for high schools in the urban, small town, and rural urbanness categories.

Further work is necessary with this sample in the area of relating individual school characteristics to the measures of performance.

I

INTRODUCTION

Two things critically curtail the ability of economists to provide insight into the efficiency of government operations. First, there are no profits to serve as guideposts; and secondly, the product itself is poorly defined. While the first of these facts makes it extremely important that economic analysis of government operations be undertaken, the second makes such analysis highly impractical.

In the education sector, the project definition difficulty is basically the inability to isolate differences in educational quality. Thus, the quantity of children educated is easily learned, but the quality of the individual educations received, other things equal, is extremely difficult to determine. To conduct economic analysis of a public sector such as education, therefore, a measure of output, which means a measure of output quality, is required. In the past several years, economists have come to believe that the achievement test score in basic subjects, while not perfect, might be such a measure.[1] This study is within that tradition.

Assuming that scores on objective tests are viable measures of school quality, and also that good objective test data are available, what kind of analysis would then be possible? While the possibilities for useful research would undoubtedly be many, there are three general types of problem which would be of central interest, at least to economists. First, what can be discovered concerning the effect upon school efficiency of increases in school size? Secondly, how much apparent return is there in terms of educational quality from the expenditure of additional dollars per pupil and how does this differ for children from different kinds of socio-economic backgrounds? Thirdly, what combinations of school inputs produce the most efficient outcomes? The last of these questions has been the subject of considerable attention on the part of economists in the past few years. Attempts to construct school "production functions"[2] have not met with unqualified success, to say the least, and it is probably fair to say that the problem is not capable of meaningful solution at the present state of the arts. Since this is true, the present study will deal almost exclusively in attempting to provide answers to the

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[1] ". . . despite . . . qualifications, we take the position that achievement in basic subjects is the most widely accepted and the most important dimension of educational output. Learning in these subjects is a necessary part of the foundation for accomplishing the things that most people, individually or as nations, seem to want. We think, therefore, that scholastic performance is an appropriate measure of output to use in comparing educational policy." Joseph A. Kershaw and Roland N. McKean, Systems Analysis and Education (Santa Monica, California: RAND Corporation, RM-2473-FF, 1959), 9.

[2] "Production Function" can be defined as the set of causal relationships between output of a process and various possible combinations

first two problems posed above with respect to the public high schools in the Project Talent Sample.[3]

The analytical scheme upon which most of the findings in this study are based is similar to that used by the author in an earlier study of school districts in New York State.[4] It is based upon the hypothesis that a person's education is dependent upon his native ability and home background (through which comes most of his educational motivation), besides his formal education. The analytical scheme is discussed in much more detail below.

After a brief description of the Project Talent data and some other studies, the remaining parts of this report will deal with the characteristics of alternative measures of performance and the analytical scheme in more detail (Part II), and detailed presentation of findings concerning the relationships of expenditure and size to performance (Parts III & IV). Finally, in Part V the findings from the study are related to those of other studies and some conclusions are given.

The Project Talent Data

There is much published material concerning the Project Talent sample of high schools and there is little reason therefore to describe it in great detail here.[5] The original Talent sample was

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of inputs. Possible inputs into school production functions would include the quantity and quality of teachers, physical plant, training aids, etc.

[3]This does not mean that much cannot be learned from an investigation into the apparent relationships which exist between school "inputs" and school quality, and the author intends to further pursue this issue with the Project Talent High Schools. An adequate attempt to delve into these relationships would have been too expensive and time consuming to come within the present study, however, especially since the data are such that supplemental data collection would have to be undertaken. Relationships between three important school characteristics and pupil performance on nine different measures are given in Table 3 below.

[4]See, Herbert J. Kiesling, "Measuring a Local Government Service: A Study of School Districts in New York State," Review of Economics and Statistics, August, 1967, pp. 356-367.

[5]The quickest way for the reader to gain a full appreciation of the Project Talent Study would be to obtain a specimen set of the Project Talent testing materials and a description of the data found in "The Project Talent Data Bank," (Project Talent, University of Pittsburgh, 1965). The latter publication includes a listing of the major publications of Project Talent on the inside front cover. A major publication not mentioned there, however, is the discussion of

comprised of 1353 high schools of all types, or about 5 percent of all the secondary schools in the United States, picked on a stratified random basis. Of the high schools in the Project Talent Sample, only the public general comprehensive and/or college preparatory high schools, of which there are 775, are used in the present study. Characteristics upon which the Project Talent Sample was stratified included geographical area, size of senior class, school category, and retention ratio (holding power). The stratification by geographical area was done according to 56 strata, including the five largest cities plus the District of Columbia along with the 50 states. Weights were assigned such that larger schools would be represented somewhat more frequently than smaller schools.[6] No effort has been made to correct for these sampling ratio differences. Since the purpose of this study is analytical in nature instead of descriptive, such a procedure would have been most expensive and time consuming considering the benefits received. Differences in sampling ratio are not great for the schools which are of greatest interest to this study, high schools with 25 or more seniors. Nor has there been a correction made for differences in weighting according to region for the same reasons. The within-region analysis given below should make such correction unnecessary in any case.

The Project Talent data were collected in the spring of the 1959-1960 school year, when pupils in the four high school grades were given sixty different tests in a two-day period. Long questionnaires were filled out by the principal, chief guidance counselor, and each individual pupil. The questionnaires were, from the point of view of economists, somewhat deficient, which is unfortunate since it would have taken little additional effort to improve some of the items of economic data a great deal.[7]

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the Talent factor score findings in Paul R. Lohnes, Measuring Adolescent Personality, (Project Talent, University of Pittsburgh, 1966).

[6]The sampling ratios used were:

Schools with fewer than 25 seniors	1:50
Schools with 25 to 399 seniors	1:20
Schools with 400 or more seniors	1:13

[7]The main criticism to be made is that the questionnaire was designed to provide intervals when many of the variables could have been made continuous just as easily. For example, one crucial item for economists has to do with teacher salary. The question for male teachers' starting salary was:

"What is the annual starting salary in your school for male secondary teachers with a bachelors degree and no experience?"

( ) 1. Less than $1000	( ) 6. $3000-$3499
( ) 2. $1000-$1499	( ) 7. $3500-$3999
( ) 3. $1500-$1999	( ) 8. $4000-$4499
( ) 4. $2000-$2499	( ) 9. $4500-$5000
( ) 5. $2500-$2999	( ) 10. $5000 or more

Footnote continued on next page.

There were originally approximately 100,000 individual pupil observations in each grade. Of these, Project Talent picked a random 10 percent sample of pupils in grades 9 and 12 and performed a complete factor analysis of their scores. Since these factor scores were important to the present study, the two 10 percent samples which include factor scores for grades 9 and 12 are those forming the basis for the analysis herein. For the 775 public comprehensive and college preparatory high schools there were about 10,700 useful observations, of which 5,000 were in grade 9 and 5,700 were in grade 12. These observations were summarized into averages according to grade, high school, and socio-economic background, and these summary statistics are the school observations for the study. As the reader will see below, the individual pupil records are also used extensively in the analysis.

The Plan of This Study Related to Prior Work

The working hypothesis being used in this study is that specific control must be exercised to account for differences both of pupil intelligence and socio-economic background before problems of the relationship of school variables to school quality can be investigated. The procedure used for accounting for socio-economic background differences has been to stratify pupils into (hopefully) homogeneous groupings, i.e., to fit the basic regression model to the performance of pupils from similar socio-economic backgrounds. The intelligence effect is accounted for, on the other hand, by introducing the intelligence variable as one of the variables in the multiple regression explanatory equation. There are no other studies, with the exception of one earlier work by the author,[8] which accounts for the important socio-economic variable with a stratification scheme. There are three studies, however, which attempt to control for intelligential and socio-economic differences before examining the formal school process. These are studies by Burkhead,[9] Coleman,[10] and Katzman.[11]

It would have been just as easy and much more exact for the principal to have filled in the exact figure. The question still would not have been bad if it had not been for the open end at the top.

[8]Kiesling, op. cit. Also see Herbert J. Kiesling, "Measuring a Local Government Service: A Study of the Efficiency of School Districts in New York State," Unpublished Ph.D. Dissertation, Harvard University Library, 1965.

[9]Jesse Burkhead, with Thomas G. Fox and John W. Holland, Input and Output in Large-City High Schools, Syracuse, N.Y., Syracuse University Press, 1967.

[10]James S. Coleman et al., Equality of Educational Opportunity, Washington, D.C., U. S. Government Printing Office, 1966.

[11]Martin T. Katzman, Distribution and Production in a Big City

The Burkhead work is a study of high schools in Chicago, Atlanta, and in the Project Talent Small Community Sample, which contains some high schools also included in this study. Quality measures used include post-high-school education, number of drop-outs, and reading scores for grade 11. Burkhead introduces both intelligence and a good socio-economic variable (median family income) as explanatory variables along with various school inputs. His use of the intelligence variable leaves something to be desired, however.[12]

The study by Coleman and associates introduces eight variables to explain pupil performance, although it would appear that none of these variables is pupil intelligence as such. The eight variables include three to represent student backgrounds and attitudes; two to represent school factors; two to represent teacher factors; and one to represent student body qualities.

Elementary School System, Unpublished Ph.D. Dissertation, Yale University Library, 1967.

Two other studies, while not attempting specifically to control for socio-economic and intelligential differences before examining school quality, are nevertheless relevant to the work in this study. These are studies by Benson and James et al. (Senate of the State of California, Committee on Revenue and Taxation, State and Local Fiscal Relations in Public Education in California, March, 1965, Chapter 4, "A Study of Pupil Achievement." H. Thomas James, J. Alan Thomas, and H. J. Dyck, Wealth, Expenditures and Decision Making for Education, Office of Education, Cooperative Research Project No. 1241, 1963.) Both studies are content to examine the gross relationship of various school and community variables to pupil performance. Professor Benson has a variable for pupil intelligence, however, but feels that the high correlation between the intelligence and achievement variables (which he argues is due to overlapping of the variables) precludes the effective use of the intelligence variable.

[12]Of the two models used, one does not use the intelligence variable at all while the other uses it incorrectly. Thus, in what Burkhead claims to be a "value added approach to high-school education" (page 53), the 11th grade test scores are predicted on the basis of 9th grade I.Q. scores and then the residuals are used as the explained variable for the explanatory model. This is an incorrect procedure which leads to biased estimators for the other explanatory variables in the model and undoubtedly greatly overstates the effect of the I.Q. variable. The basic problem involved is that the procedure does not properly allow for interaction effects. The correct procedure would have been to make I.Q. one of the explanatory variables along with the others. For a proof of this, see Arthur S. Goldberger, Econometric Theory, New York, John Wiley and Sons, 1964, pp. 194-195.

Finally, Martin Katzman has studied 56 school "districts" in Boston in an attempt to explain school quality as measured by six variables. The quality variables used include attendance rate, membership rate, gains in reading score between grades 2 and 6, the percentage of children applying to Boston Latin School, the percentage of children being admitted to Boston Latin School, and continuation rate. These measures of performance are related to various school characteristics net of the effect of an aggregate socio-economic background variable. Katzman does not account for differences in pupil intelligence. The explanatory variables in Katzman's model include, besides the socio-economic background variable, the percentage of students in crowded classrooms, pupil staff ratio, percent teachers with permanent status, percent of permanent teachers with Masters Degrees or better, percent teachers with one to ten years' experience, percent annual teacher turnover, and percent of student members in the district. One problem with the Katzman study is that the independent observations might not be truly independent.[13]

Some of the findings from the study just mentioned plus those mentioned in Footnote 11 will be discussed in the final section of this paper after the findings from the present study have been discussed. Before the findings can be given, however, it will be necessary to discuss the quality measures being used in some detail (Part III).

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[13]Katzman's "school district" is not the school district using the accepted meaning of the term which is an independent policy-making, often highly autonomous, educational entity. The 56 school "districts" in the city of Boston have little or no independent policy-making discretion, do not decide teacher salary levels, do not in the main decide other expenditure questions. These questions are all settled centrally by the Boston School Committee. There is some question, therefore, whether Katzman has 56 observations in the accepted sense of degrees of freedom for econometric analysis. The fact that Katzman gets unbelievably high coefficients of corrected multiple determination in many of his multiple regressions is probably in part due to this lack of independence.

This criticism is also applicable to the Burkhead study of high schools in Chicago and Atlanta.

II

CONSTRUCTING A QUALITY MEASURE FOR EDUCATION

It is probably true that objective comparison of relatively large numbers of schools or school districts will require results of objective tests. But what kind of tests, concerned with what kind of subject matter, might be best as a measure of school quality? Also, and just as important, is it possible to construct a good measure of pupil native ability? It is to these questions that Part II is devoted.

A total of 12 different measures were considered for use as quality measures for this study. These measures belong to three distinct sets or types, according to the methodology of their construction. The first set, comprising four tests, are "traditional" types of tests, where pupils are asked to answer multiple choice questions constructed along various subject lines. The four tests used have for their subject matter English, Mathematics, General School (academic subject) Aptitude, and General Technical Aptitude. The Technical Aptitude test covers such things as the knowledge of engines, electricity, physical laws, etc. The teaching of such skills conceivably is an important facet of school quality which is not captured in the more academic measures.

The second type of measure used, consisting of three tests, is based upon the presumption that one important aspect of school quality has to do with the number of facilities offered by the school to its pupils.[14] Three such measures were constructed by the author to be made up of various combinations of answers on the General School Questionnaire. They are based upon the special facilities available, and total number of courses available in the school curriculum.[15]

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[14]Two political scientists, Henry J. Schmandt and G. Ross Stevens, have argued that a good indication of the quality of public service outputs is obtained by counting the number of services offered. ("Measuring Municipal Output," National Tax Journal, December 1960, pp. 369-375.) There are serious drawbacks to such a procedure and yet the basic idea might in certain instances be useful. The basic drawback to the approach is that the relative importance and quality of the different services is ignored.

[15]The three measures were constructed as follows:

Special Facilities Measure. The special facilities measure was meant to capture the facilities available for educating better-than-average pupils. The measure contains 22 items: number of tracks (4), number of separate classes available (such as classes for the mentally retarded, non-English speaking, rapid learners, etc.) (12), and number of types of accelerated curriculum available (6).

Total Facilities. Principals were asked to check the number of facilities provided from a list on the back of the school questionnaire. There were 37 items on the list and three more provided rather often by the principals, for a total of 40. The first 10 items on the list are:

The third set of potential measures of output consists of five factor scores, which along with the sixth factor score for pupil intelligence, must be discussed in somewhat more detail. While not as straight forward to interpret, the pattern of underlying trait relationships for these factors seems to be accepted fairly widely by educational psychologists. If this is true, it would be of great importance, since the chances are that similar normalized factor scores might be drawn from dissimilar starting batteries of tests.

To understand the factors themselves, it is necessary to be aware of the general theoretical construct on which they are based, and, although this is outside the author's professional competence, a brief attempt to give the rudiments of the construct is given here.[16] The discussion is based upon the Project Talent description of the factors written by Paul R. Lohnes.[17] According to Lohnes, human abilities are arranged into a hierarchy of traits, with general intelligence serving as the basic foundation stone. Lohnes attributes this approach to Robert Gagné, although a similar theory was also enunciated in Vernon.[18]

> "Gagné holds that individual differences in rate of achievement are related to differences in amount and kinds of available relevant knowledge. These knowledges are organized in a hierarch of learning sets, in which subordinate sets mediate transfer to higher level sets. Incidently, he hypothesizes lower-level learning sets that are quite similar in nature to what we will define as aptitudes. He makes acquisition of

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health examination, school library, health clinic, social worker or visiting teacher, teacher of the "home bound," free lunches, school doctor, school dentist, recreation worker, and school psychologist.

Curriculum Measure. The principals were also asked to check which courses were available at their high schools on a long list of potential courses provided in the questionnaire. The total number of items possible in this measure is 308. The following are the types of courses included in the measure along with the number of possible offerings for each provided for in the questionnaire: English (28), Social Studies (29), Science (42), Mathematics (15), Foreign Languages (49), Industrial Arts non-vocational (34), Business Education (32), Home Economics (22), Religious (7), Agriculture (15), Music (14), Art (13), Other Instruction (8).

[16]The author is deeply indebted to Professor Richard L. Turner, an educational psychologist in the Indiana University School of Education, for helpful insights into the general meaning of the theoretical issues underlying the discussion to follow. It must be most emphatically stated, however, that Professor Turner should not be held responsible for any errors of interpretation that exist.

[17]Op. cit.

[18]Philip E. Vernon, The Structure of Human Abilities, New York, John Wiley and Sons, 1950. Also see Anne Anastasi, Individual Differences, New York, John Wiley and Sons, 1965.

required specific knowledges dependent upon the mediation of appropriate aptitudes, in part, and in turn, higher level achievements (what we would call higher mental processes) depend primarily on transfer from immediately subordinate specific knowledges. Gagné's paradigm is essentially this:

COMPLEX ABILITIES

↑

BASAL KNOWLEDGES

↑

DIFFERENTIAL APTITUDES

Gagne's theory suggests that there is a particular bundle of special knowledges that must be assembled to permit mastery of a particular complex ability. Our footnote to this is that a pervasive source trait of general intelligence collaborates with a special set of lower-level aptitudes in facilitating the acquisition of any special set of basal knowledges." (Page 1-32)

Standing on the foundation of intelligence, there are two other source traits upon which, together with intelligence, all other abilities are based, i.e., all ability traits are constructed from differing combinations from these three "building blocks." There are two "basal knowledges," having to do with language and mathematics skills.

"A knowledge is a performance trait that enables the subject to reproduce associations or to complete Gestalts from a broad class of cognitive holdings. A knowledge trait is an ability to generate and apply information in a subject-matter area. Knowledges may depend more on specific learning opportunities and less on inate characteristics of the central nervous afferent and efferent systems than do aptitudes. . . . Two important knowledge factors, uncorrelated with Verbal Knowledges and uncorrelated with each other, appear in our theory: English Language and Mathematics." (Page 1-33)

Finally, there are the specialized abilities.

"An aptitude is a performance trait that facilitates speed and precision of response to items from a specific, unique class of relatively simple tasks. Our theory locates three such classes of tasks in the TALENT abilities test, and defines as a set of three differential aptitude factors Visual Reasoning, Perceptual Speed and Accuracy, and Memory, each of which has ample precedent in the literature." (Page 1-33)

Individual Tests Associated with Each Factor

Additional insight can be obtained from an examination of the nature of the individual Project Talent tests which make up, or "load highly upon," each factor score. This is done in this section for the six scores beginning with the one for pupil intelligence.

The Verbal Knowledges Factor

The Verbal Knowledges Factor is meaningfully associated positively with 37 of the 60 Project Talent tests and the factor itself accounts for 18.7 percent of the total variance generated by the 60 tests. According to Lohnes the Verbal Knowledges Factor is:

> ". . . our closest approximation to General Intelligence or I.Q. Technically, (Verbal Knowledges) is a _g_ factor, since every single one of the 60 ability tests has a positive non-zero correlation with this factor. . . Spearman insisted on the "purely formal character" of _g_, saying: 'It consists in just that constituent--whatever it may be--which is common to all the abilities. . .' He defined _g_ not by what it is, but by where it can be found. The only requirement is that _g_ must 'enter into all abilities whatsoever.' (The Verbal Knowledges Factor Score) satisfied this requirement." (Page 3-20)

It is not possible to list all 25 of the tests which loaded strongly and consistently with the Verbal Knowledges Factor. The reader is referred to the Lohnes' discussion for more detail. The ten tests which were most correlated with the factor, in order of importance, are: Art, Social Studies, Literature, Foreign Travel, Vocabulary, Music, Theatre and Ballet, Reading Comprehension, Bible, and Miscellaneous Information.

It is important to notice that the title "Verbal Knowledges" is probably somewhat artificial since it is used merely as a name less susceptible of misunderstanding than the term "intelligence."[19] It is true, also, that the factor is made up more of language traits than, say, mathematics traits. Many educational psychologists seem to feel that general intellectual ability is highly associated with language skills.[20]

English Factor

The tests which are highly correlated with the English Factor include Disguised Words, Spelling, Capitalization, Punctuation, English Usage, Effective Expression, Word Functions and Sentences, Reading Comprehension, Arithmetic Reasoning, and Arithmetic Computation. Of these the disguised words and reading comprehension tests were more highly associated with the Verbal Knowledges Factor than the English Factor. It might be hypothesized perhaps that the tests which are listed, with the exception of the reading comprehension and arithmetic tests, seem to be English skills of a more mechanical or secretarial variety. If so, it could be that such skills would not be more prevalent at high schools which are better academic institutions. Also, pupils who are more interested in such skills might be found in low (but not the _lowest_) socio-economic strata.

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[19] See Lohnes, _op. cit._, page 3-20.

[20] Lohnes, _ibid._

Mathematics Factor

It is possible that the Project Talent Mathematics Factor is theoretically a good measure of school quality, since mathematical ability is probably a more school-related trait than language ability. Verbal ability can easily be learned in highly literate homes; some such knowledge is transmitted regardless of how good or how bad the formal education process might be. Mathematical skills are, on the other hand, gained at home much less often. Even when the parents are adept at mathematics, such as would be true with engineers for example, there must still be a conscious effort made on the part of the parent to teach the skill (helping with homework). It is problematical that such an effort is often made to teach the child concepts when they are not being covered at the same time in school.

A second, somewhat more tenuous, reason why the Mathematics Factor might be a good school quality measure is that the Verbal Knowledges Factor, while removing some academic language skills from the English Factor, does not do the same with academic mathematics skills with respect to the Mathematics Factor.[21] Individual tests which are highly correlated with the Mathematics Factor include Mathematics (a test also used as an output measure in this study), Physical Sciences, Introductory Mathematics, and Advanced Mathematics.

Visual Reasoning Factor Score

Tests which are associated with the Visual Reasoning Factor are Creativity, Mechanical Reasoning, Visualization in Two Dimensions, Visualization in Three Dimensions, and Abstract Reasoning. From the names of these tests, it seems likely that the Visual Reasoning Factor measures a kind of intelligence trait. Evidence presented below seems to indicate that it is an ability learned by pupils who are pursuing studies which are vocational in nature.

Perceptual Speed and Accuracy and Memory Factor Scores

The final two factors seem to represent skills that are unrelated to academic excellence and also, perhaps, to general intelligence. The first of these, Perceptual Speed and Accuracy, is a clerical checking factor which includes loadings on the following tests: Arithmetic Computations, Table Reading, Clerical Checking, Object Inspection, and Preferences. The Memory Factor has to do with the ability to do rote memorization. Two tests load on it, Memory for Sentences, and Memory for Words. It might be hypothesized that institutions which stress clerical and rote memory skills do so at the expense of academic excellence.

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[21] My thanks go to Professor Richard Turner for suggesting this point.

Summary: Factor Scores

To summarize what has been said thus far with respect to the Project Talent factor scores, mathematics would seem to be on a priori grounds the best measure. The English Factor appears to include only the mechanical side of English skills, although perhaps it is important for this facet of formal education to be carefully examined also. It is reasonable to accept the general intelligence factor (Verbal Knowledges) as a good I.Q. measure. The Visual Reasoning Factor could measure a type of intelligence that goes with vocational education. The Perceptual Speed and Accuracy and Memory factors are probably unrelated to school academic excellence, and it may also be possible to say the same thing, to some extent at least, about the English Factor.

Empirical Exploration Concerning the Measures of School Quality

It might be possible to learn something more about these 12 potential measures of school quality by examining their relationships to other variables about which we can reasonably expect to have some a priori notions. Five such variables are related to the quality measures: one to represent pupil intelligence, one for pupil socioeconomic background, and three for school quality.

Such a procedure includes an element of non-rigorous reasoning. To illustrate this, suppose it is assumed, perhaps on the basis of past empirical investigation, that average class size is highly related negatively to school excellence. Having made this assumption, class size is related to (regressed upon) a potential quality measure. Suppose further that this yields a finding of "no relationship" between the two variables. In this situation there is reason to suspect that the quality measure is a poor one. But the measure may in fact be a good one; the problem is that the hypothesized relationship between average class size and quality is false. Formally, there are two unknowns but only one equation. Or, more correctly, the second equation is somewhat intuitive in nature, since no one can be absolutely certain that the variables measure the qualities attributed to them. Despite this lack of complete rigor, there is evidence which can be cited in support of the hypothesized relationships for five variables and the value of this procedure should not be underestimated.[22] The hypothetical and empirical relationships of these five variables to the output measures will be discussed in turn, beginning with the intelligence variable.

Pupil Intelligence and Quality

Two possibilities exist with respect to the relationship of pupil intelligence to school quality. The first, which is the relationship

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[22]See Herbert J. Kiesling, "Empirical Evidence Concerning the Relative Educational Performance of Children from Disadvantaged

that will be assumed here, is that good schools make material available such that more intelligent pupils learn relatively more than they would in inferior schools.[23] A second, less plausible, relationship might be that more intelligent pupils are bright enough to learn well even in poor schools.[24]

The 12 potential measures of quality are related to general pupil intelligence (the Verbal Knowledges Factor score) in Table 1. The relationships there are given in the form of beta weights with the applicable values of the t-statistic given under each.[25] The beta weights in Table 1 represent the intelligence-performance relationships net of the effects of school expenditure, school size, and average pupil socio-economic index. The reader is advised that for purposes of this discussion the term "intelligence" is meant to mean the Project Talent Verbal Knowledges Factor score, and not some more generalized or popular interpretation of the term.

On the basis of the assumption made above, it would appear from Table 1 that the traditional achievement measures (English, Mathematics, General School Aptitude, and General Technical Aptitude) are good ones and the Facilities and Curriculum Measures are poor ones. The Verbal Knowledges Factor is strongly and significantly related to all four of the traditional measures while its relationship to the facilities and curriculum measure is practically nonexistent. The relationship

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Backgrounds," Federal Programs of the Development of Human Resources: A Compendium of Papers Providing an Economic Analysis, Joint Economic Committee, U.S. Congress, forthcoming.

[23]The word relatively is important to the argument here. Thus, better schools would be expected to give better educations to all pupils, whether of high or low intelligence. But the very concept of intelligence would give support to the argument that better schools import relatively more, i.e., greater absolute amounts of, learning to the more intelligent pupils. If this is true, the result that pupil intelligence and a good school quality measure should be highly correlated follows.

[24]Certainly all of the evidence from the author's own empirical research would seem to substantiate the former claim. Thus, more intelligent pupils do in fact perform better in "better" schools, although the relationship is often not strong enough to allow total confidence on the point.

Some insight can also be gained here about the identification problem between the intelligence test and achievement tests which will be discussed more thoroughly below (pages 36). Thus, when the school is of high quality, the index of brightness itself is higher. For purposes of this particular section, however, that relationship is not detrimental, since it leads to the hypothesized close relationship between the intelligence score and school excellence.

[25]A more complete discussion of the meaning of the figures in the tables are given in the notes to each table.

TABLE 1

RELATIONSHIP OF PUPIL INTELLIGENCE AS MEASURED BY THE VERBAL KNOWLEDGES FACTOR SCORE TO 12 POSSIBLE MEASURES OF SCHOOL QUALITY, FOUR SOCIO-ECONOMIC QUARTILES AND ALL PUPILS TOGETHER, GRADES 9 AND 12.

TESTS	GRADE 9					GRADE 12				
	S-E 1	S-E 2	S-E 3	S-E 4	All Pupils	S-E 1	S-E 2	S-E 3	S-E 4	All Pupils
English	0.476 (8.06)**	0.319 (6.19)**	0.303 (6.56)**	0.233 (5.20)**	0.345 (7.70)**	0.370 (6.65)**	0.404 (8.65)**	0.382 (8.56)**	0.352 (8.19)**	0.375 (11.23)**
Mathematics	0.586 (10.95)**	0.359 (7.14)**	0.385 (8.82)**	0.314 (7.36)**	0.439 (8.48)**	0.366 (6.76)**	0.419 (8.94)**	0.431 (9.97)**	0.385 (8.99)**	0.508 (11.14)**
General School Aptitude	0.664 (13.28)**	0.500 (10.61)**	0.485 (11.84)**	0.438 (11.05)**	0.536 (12.36)**	0.531 (10.63)**	0.568 (13.58)**	0.584 (15.14)**	0.555 (14.77)**	0.596 (17.41)**
General Technical Aptitude	0.674 (13.83)**	0.625 (14.77)**	0.492 (12.08)**	0.573 (16.14)**	0.700 (15.36)**	0.541 (10.71)**	0.539 (12.31)**	0.541 (13.40)**	0.553 (14.03)**	0.641 (14.84)**
Visual Reasoning Factor	0.155 (2.41)*	0.190 (3.55)**	0.056 (1.12)	0.129 (2.85)**	0.235 (4.51)**	-0.013 (0.22)	0.022 (0.42)	0.064 (1.33)	0.121 (2.56)*	0.049 (0.99)
Perceptual Speed and Accuracy Factor	-0.207 (3.24)**	-0.058 (1.06)	0.010 (0.20)	-0.073 (1.57)	-0.017 (0.28)	-0.108 (1.80)	-0.009 (0.17)	-0.083 (1.74)*	-0.017 (0.34)	-0.132 (2.46)*
Memory Factor	-0.169 (2.58)*	-0.125 (2.30)*	-0.078 (1.56)	0.019 (0.39)	-0.081 (1.37)	-0.190 (3.22)**	-0.057 (1.09)	0.169 (3.51)**	-0.016 (0.33)	-0.091 (1.76)
English Factor	-0.042 (0.63)	-0.170 (3.15)**	-0.049 (0.97)	-0.161 (3.39)**	-0.066 (1.10)	-0.210 (3.56)**	-0.178 (3.49)**	0.131 (2.69)**	-0.128 (2.72)**	-0.080 (1.59)
Mathematics Factor	0.122 (1.86)	0.019 (0.34)	-0.057 (1.12)	-0.042 (0.87)	0.048 (0.86)	0.196 (3.41)**	0.205 (4.00)**	0.138 (2.84)**	-0.009 (0.19)	0.040 (0.77)
Special Facilities Measure	0.017 (0.31)	0.007 (0.18)	0.039 (1.02)	0.064 (1.80)	0.072 (1.46)	0.065 (1.41)	-0.005 (0.13)	0.044 (1.23)	-0.065 (1.86)*	0.014 (0.30)
Total Facilities Measure	-0.006 (0.10)	0.088 (1.75)	0.021 (0.45)	0.022 (0.51)	0.080 (1.27)	0.065 (1.41)	0.065 (1.34)	0.073 (1.62)	0.042 (0.97)	0.129 (2.26)*
Curriculum Measure	0.058 (1.14)	0.035 (0.85)	-0.002 (0.06)	-0.005 (0.15)	-0.002 (0.03)	0.073 (0.85)	0.058 (1.43)	0.057 (1.53)	0.011 (0.32)	0.090 (1.94)*
Number of Schools	233	348	428	491	589	301	396	464	516	636

NOTES: See next page.

Notes, Table 1

Beta Coefficient

A beta coefficient is defined as the relative number of standard deviations of the dependent variable associated with a change of one standard deviation of the independent variable.

Statistical Significance

The statistical significance for these tables is shown by the values of the t-statistic which is always shown in parenthesis under the beta coefficients. The level of statistical significance is denoted by the asterisks next to the value of t. Thus, one asterisk means that the probability is only 5 out of 100 that the beta coefficient associated with that value of t could have been generated completely by chance. The presence of two asterisks next to the value of t means that the chances are only 1 in 100 of this being true. Statisticians often describe these two situations as being "significant at the 95 percent level" and "significant at the 99 percent level," respectively.

A convenient rule of thumb for statistical significance is that if the t-value is in excess of 1.6 the relationships is, except when there are only a very few observations, significant at 90 percent; that when the t-value is in excess of 2.0 the relationship is significant at 95 percent; and when the value of t is in excess of 2.6 the relationship is significant at the 99 percent level. Finally, a value for the t-statistic in excess of 2.7 normally indicates, for the number of observations in this study, a level of significance of 99.9 percent.

Other Variables in the Multiple Regression Equation

The beta coefficients given are net of the effects of pupil socio-economic background, high school expenditure per pupil and high school size. See also the detailed discussion of the model on pages 33-43.

of the intelligence factor to the other five factor scores is more ambiguous, however. Findings for each factor score are discussed in turn.

1. *English*. The relationship between intelligence and the English Factor is generally *negative*, with the relationship being stronger in grade 12 than in grade 9. This relationship is somewhat surprising, even dispite the fact that the English Factor was represented above as being more related to English skills of a mechanical nature than to academic language ability. The evidence here would seem to suggest that such mechanical English skills are taught at the expense of overall academic quality, and that this relationship becomes more pronounced as pupils move through the formal education process.

2. *Mathematics Factor*. As discussed above, the Mathematics Factor is probably a much more legitimate academic factor than the English Factor. The findings in Table 1 tend to support such a contention. Thus, the general intelligence factor and the mathematics factors are more positively and highly correlated for pupils from the high socio-economic backgrounds as opposed to lower, and also for pupils in grade 12 as opposed to grade 9. The high socio-economic class finding shows the effect of the better motivation of such children, while the difference in grade can be explained by the fact that mathematics is indeed a subject that is taught in the four high school grades. As the grade level becomes higher the content of mathematics courses becomes more closely related to the formal education process.

3. *Visual Reasoning Factor*. Intelligence is related to the Visual Reasoning Factor strongly in the 9th grade with one exception, but is unrelated, again with one exception (the lowest socio-economic quartile) in grade 12. A plausible explanation for this finding, perhaps, is that Visual Reasoning is a skill which is acquired in relatively greater amounts by pupils who study vocational as opposed to academic courses of study. The significant relationship for pupils in the lowest socio-economic backgrounds would also support this finding, since it is such pupils who more often pursue studies in vocational training. An alternative explanation for the finding which cannot be ruled out is that, although such skills are necessary and important, American high schools are merely failing to impart this type of skill to their students.[26]

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[26]These remarks can be related to findings cited by Professor Vernon (*op. cit.*, pages 73-74), in which the relationship of technical-vocational skills to mechanical-spacial-mathematical skills changes from lower to higher grades. In the lower grades the two trait patterns are unrelated while in the higher grades they seem to link-up with the mechanical-spacial-mathematical trait pattern becoming disassociated from general academic traits where it is at the lower grade levels. Vernon explains this as "probably . . . due to the influence of science training both on mechanical-spacial and mathematical abilities." (page 73). If this is true, it is still difficult to explain why the Project Talent Visual Reasoning Factor, which represents special abilities, becomes less related to the *intelligence* factor in the higher grades.

4. Perceptual Speed and Accuracy and Memory Factor Scores. These two factors are similar and can therefore be discussed together. The findings tend to confirm the hypothetical speculations given above: Both are unrelated or negatively related to intelligence at both grade levels. It would appear that clerical and rote-learning skills are not related to academic excellence in any positive way.

Pupil Socio-Economic Index and Quality

What can be hypothesized about the relationship of the socio-economic index and school quality? Ideally, perhaps, it would be desirable to have schools that teach the same amount of material to children regardless of their socio-economic background. But the real world is not ideal, and parents in higher socio-economic situations succeed in motivating their offspring into having a greater relative demand for education. The hypothesized relationship therefore is positive and significant, but not as strong as the positive relationship for intelligence.

The Project Talent socio-economic index is composed of eight sub-indexes which are weighted equally. These include: value of home, family income, number of books in the home, number of appliances in the home, number of high cost appliances in the home, amount of study space enjoyed by the pupil, father's occupation, father's education, and mother's education. The findings for the relationship of the socio-economic index to the 12 output measures, which is net of the effects of pupil intelligence, school size, and school expenditure, are given in Table 2.

The relationship of the socio-economic variable to the four "traditional" quality measures is not unlike that for the intelligence variable except for the lack of relationship, further discussed below, between performance and socio-economic index in the top two quartiles. Also the relationship is much greater for all pupils taken together than for pupils when broken into quartiles, a finding which is only to be expected since the quartile breakdown is itself based upon the socio-economic index. In view of the general strength of the socio-economic index when all pupils are taken together, the insignificant relationship for all pupils for the technical aptitude score is interesting. The non-importance of the relationship in the top two quartiles (including a negative relationship in the second quartile) evidently swamps the significant relationships for children in the lower socio-economic categories. That a non-academic subject such as Technical Aptitude is relatively more important for pupils in the lower socio-economic strata is itself quite reasonable.

With respect to the five factor scores, the results for the four quartiles are quite similar to the results for the intelligence factor discussed above, perhaps for the same reasons. However, when all pupils are considered together, all five of these traits are characteristics which increase with better socio-economic background. The difference in the results for all pupils for the socio-economic variable as

TABLE 2

RELATIONSHIP OF THE PUPIL SOCIO-ECONOMIC INDEX TO 12 POSSIBLE MEASURES OF SCHOOL QUALITY, FOUR SOCIO-ECONOMIC QUARTILES AND ALL PUPILS TOGETHER, GRADES 9 AND 12

TESTS	GRADE 9					GRADE 12				
	S-E 1	S-E 2	S-E 3	S-E 4	All Pupils	S-E 1	S-E 2	S-E 3	S-E 4	All Pupils
English	0.0076 (0.13)	0.047 (0.86)	0.174 (3.70)**	0.131 (2.95)**	0.439 (9.93)**	0.069 (1.18)	0.155 (3.27)**	0.130 (2.80)**	0.267 (6.04)**	0.563 (17.59)**
Mathematics	0.002 (0.00)	0.021 (0.39)	0.137 (3.08)**	0.166 (3.90)**	0.178 (3.48)**	0.082 (1.43)	0.100 (2.11)*	0.137 (3.05)**	0.200 (4.54)**	0.220 (5.04)**
General School Aptitude	0.013 (0.25)	0.030 (0.61)	0.160 (3.84)**	0.150 (3.81)**	0.233 (5.45)**	0.051 (0.97)	0.134 (3.16)**	1.131 (3.26)**	0.230 (5.96)**	0.311 (9.49)**
General Technical Aptitude	0.041 (0.81)	-0.044 (0.97)	0.112 (2.70)**	0.119 (3.37)**	-0.007 (0.15)	0.048 (0.90)	0.026 (0.59)	0.079 (1.88)*	0.082 (2.01)*	0.126 (3.04)**
Visual Reasoning Factor	0.117 (1.74)*	-0.036 (0.63)	0.108 (2.12)*	0.154 (3.41)**	0.438 (8.55)**	0.049 (0.77)	0.046 (0.87)	0.009 (0.18)	0.113 (2.33)*	0.609 (13.03)**
Perceptual Speed and Accuracy Factor	-0.055 (0.84)	0.031 (0.53)	-0.047 (0.91)	0.026 (0.56)	0.517 (8.91)**	0.034 (0.54)	-0.092 (1.72)*	-0.158 (3.16)**	-0.078 (1.56)	0.607 (11.79)**
Memory Factor	0.034 (0.50)	-0.017 (0.29)	-0.042 (0.82)	0.012 (0.24)	0.575 (9.86)**	-0.079 (1.28)	-0.067 (1.27)	-0.034 (0.68)	0.018 (0.36)	0.639 (12.85)**
English Factor	-0.098 (1.42)	0.053 (0.92)	0.107 (2.08)*	0.057 (1.22)	0.537 (9.07)**	0.006 (0.10)	0.149 (2.87)**	0.118 (2.33)*	0.227 (4.69)**	0.677 (14.00)**
Mathematics Factor	0.026 (0.38)	-0.075 (1.31)	-0.048 (0.94)	-0.568 (0.57)	0.553 (10.05)**	0.067 (1.12)	0.001 (0.02)	0.040 (0.70)	-0.059 (1.19)	0.545 (10.99)**
Special Facilities Measure	-0.013 (0.24)	0.050 (1.11)	0.054 (1.39)	0.049 (1.39)	0.002 (0.03)	0.020 (0.41)	-0.005 (0.11)	0.058 (1.55)	0.101 (2.82)**	0.023 (0.53)
Total Facilities Measure	-0.120 (1.84)*	0.101 (1.90)*	0.110 (2.30)*	0.199 (4.54)**	0.051 (0.82)	-0.015 (0.26)	0.001 (0.02)	0.071 (1.53)	0.167 (3.75)**	0.058 (1.07)
Curriculum Measure	-0.020 (0.37)	0.093 (2.13)*	0.161 (4.11)**	0.224 (6.17)**	0.134 (2.68)**	-0.042 (0.85)	0.053 (1.28)	0.122 (3.15)**	0.202 (5.56)**	0.062 (1.39)
Number of Schools	233	348	428	491	589	301	396	464	516	636

NOTES: See next page

Notes, Table 2

Beta Coefficient

A beta coefficient is defined as the relative number of standard deviations of the dependent variable associated with a change of one standard deviation of the independent variable.

Statistical Significance

* = Significant at 95%

** = Significant at 99%

See also the notes to Table 1, page 16.

Other Variables in the Multiple Regression Equation

The beta coefficients are net of the effects of pupil intelligence, high school expenditure per pupil, and high school size. See also the detailed discussion of the model on pages 33-43.

opposed to those for the intelligence variable might be attributable to the difference between the effects of increased motivation on the one hand as opposed to increased intelligence on the other.

Of the three facilities measures, finally, only those for total facilities and curriculum are related to the socio-economic index. This result is curious because the special facilities measure is based primarily upon the facilities available for better-than-average pupils. The Curriculum Measure is most consistently related to the socio-economic nature of the community. This positive relationship, plus that for expenditure (see below), suggests that the curriculum measure (also, to a lesser extent, the total facilities measure.) is a viable quality measure when the effect of size is properly taken into account. As will be seen below, the relationship of these measures to size is almost overwhelming.

A Digression: Some Implications of the Socio-Economic Findings

Since the relationship of the performance of these high school pupils to the socio-economic backgrounds of their classmates will not be discussed elsewhere in this report, it will be worthwhile, due to the importance of the subject, to make a brief comment here.[27]

Perhaps the most important finding in Table 2, especially in light of the similar results shown in the Equal Opportunities Study,[28] is that the socio-economic variable is much more highly correlated with the performance of pupils in the lower two socio-economic quartiles. The social background of classmates seems much more important to pupils whose background are relatively disadvantaged. The performance of children in the top socio-economic quartile, on the other hand, is completely unrelated to the socio-economic backgrounds of their peers.

Secondly, it is interesting that the socio-economic relationships are remarkably stable between the 9th and 12th grade levels. This suggests perhaps that the changes noted between the grades for the school variables are in fact attributable to the schools and not to environmental changes.

A third interesting result for the socio-economic variable is the increased importance it assumes in the regressions which include all pupils over those which include pupils belonging to a single socio-economic quartile. This is especially true for the factor scores. An important implication of this difference in relationship is that the stratification scheme probably does not do a bad job of holding socio-economic background differences constant despite the fact that the intervals used (quartiles) could be a great deal narrower.

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[27]This subject is discussed also and in more detail in Kiesling, Joint Economic Committee, op. cit.

[28]Coleman et al, op. cit.

TABLE 3

THREE IMPORTANT SCHOOL VARIABLES RELATED TO NINE SCHOOL QUALITY MEASURES, GRADES 9 AND 12

Quality Measure \ Variable	GRADE 9			GRADE 12		
	Starting Salary Male Teachers	Class Size, Science and Mathematics Courses	Class Size, Non-Science and Mathematics Courses	Starting Salary Male Teachers	Class Size, Science and Mathematics Courses	Class Size, Non-Science and Mathematics Courses
English	0.086 (2.90)** [6.35]**	-0.043 (1.62)* [1.12]	-0.097 (3.21)** [3.50]**	-0.028 (1.18) [5.33]**	-0.0012 (0.06) [0.40]	-0.0009 (0.04) [0.23]
Mathematics	0.232 (6.71)** [7.69]**	-0.023 (0.70) [1.10]	-0.196 (5.51)** [6.12]**	0.154 (4.82)** [8.90]**	-0.046 (1.59) [0.36]	-0.080 (2.44)* [0.76]
General School Aptitude	0.192 (6.72)** [8.27]**	-0.045 (1.69)* [1.45]	-0.164 (5.58)** [5.25]**	0.082 (3.43)** [8.42]**	-0.038 (1.80)* [0.12]	-0.059 (2.44)* [0.40]
General Technical Aptitude	0.184 (6.04)** [6.14]**	-0.056 (2.01)* [2.43]*	-0.159 (5.11)** [6.72]**	0.164 (5.42)** [8.04]**	-0.068 (2.47)* [1.36]	-0.152 (4.94)** [3.70]**
English Language Factor	0.029 (0.73) [3.39]**	-0.022 (0.60) [0.39]	-0.056 (1.38) [1.97]*	-0.112 (3.14)** [0.53]	0.013 (0.40) [0.09]	0.051 (1.41) [0.51]
Mathematics Factor	-0.133 (3.67)** [0.29]	0.019 (0.57) [0.22]	0.022 (0.59) [1.67]*	0.039 (1.08) [4.81]**	0.0029 (0.09) [0.40]	-0.010 (0.27) [0.57]
Special Facilities Measure	0.143 (4.29)** [11.35]**	-0.011 (0.35) [2.93]**	0.023 (0.67) [7.85]**	0.141 (4.39)** [11.84]**	-0.0091 (0.31) [3.23]**	-0.024 (0.74) [9.02]**
Total Facilities Measure	0.126 (2.96)** [7.29]**	0.005 (0.13) [1.81]*	-0.016 (0.37) [3.75]**	0.108 (2.68)** [8.02]**	0.0046 (0.13) [2.15]*	0.015 (0.36) [5.27]**
Curriculum Measure	0.150 (4.48)** [11.87]**	0.052 (1.71)* [4.48]**	0.022 (0.63) [8.49]**	0.132 (4.07)** [12.08]**	0.048 (1.66)* [4.56]**	0.026 (0.78) [9.54]**
Number of Schools	607	608	607	659	655	656

NOTES: See next page.

Notes, Table 3

Beta Coefficient

A beta coefficient is defined as the relative number of standard deviations of the dependent variable associated with a change of one standard deviation of the independent variable.

Statistical Significance

* = Significant at 95%

** = Significant at 99%

See also the notes to Table 1, page 16.

Other Variables in the Multiple Regression Equation

The beta coefficients are net of the effects of pupil intelligence and pupil socio-economic background. The values of the t-statistic in the parentheses under the beta coefficients are applicable to the computed beta coefficients which are given. The values of the t-statistics which are given in the brackets, however, are applicable to the beta coefficients of net regression which obtain when the explanatory variable (the variable named at the top of the column) is the only explanatory variable in the multiple regression equation. See also the detailed discussion of the model on pages 33-43.

Empirical Evidence Relating Selected Quality Measures to Starting Salary of Male Teachers and Class Size in Science and Non-Science Courses

There is of course no problem in postulating the expected relationship of school quality to variables representing class size and teacher salary. The author's own past work seems to strongly suggest that such variables are more consistently related to school quality than any other.[29]

Table 3 gives the relationships of the three variables--net of the effect of school size, pupil intelligence, and pupil socio-economic background--to nine of the quality measures for all pupils.[30] The three "abilities" factor scores--shown above to be unsuitable measures for school quality--are not included. The reader is reminded that the correct sign for the two class-size variables is negative.

In general the relationships shown in Table 3 are similar to those for intelligence and socio-economic background, demonstrating again that all of these variables work in the same direction.[31] Teacher salary is strongly related to all the "traditional"[32] and facilities measures in grade 9 and to all of these except for the English score in grade 12. Again the hypothesis that English is a relatively non-school related skill and thus an inferior measure of school quality seems to be supported.

The class-size variables are with one exception quite similar to those for teacher salary for the four traditional measures. The exception is that class size in science and mathematics courses is related only to the General Technical Aptitude score. That the size of science and mathematics classes would be most related to technical skills is of course quite plausible.

The class-size variables are not very highly related to the facilities measures.

The relationships shown for the English and Mathematics Factor scores, finally, are consistent with the roles for these measures which are hypothesized above, except that a more significant relationship between the Mathematics Factor score and starting salary in

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[29]Kiesling, Joint Economic Committee, op. cit.

[30]Unfortunately, it was not possible to perform the computations for the individual socio-economic background (by quartile) at the time of writing. The findings for all pupils taken together should be instructive enough for our purposes, however.

[31]This does not necessarily mean that the variables represent the same things.

[32]The term "traditional" is used here and below to mean achievement type objective tests and the quotations will not be used further.

grade 12 would be indicated if the supposition that the Mathematics Factor score is a good quality measure is true.

Summary: Implications for the Quality Measures of the Empirical Relationships

To summarize the empirical findings for the quality measures, it would appear that the four traditional measures are good quality measures in general, although this is less certain perhaps for English and Technical Aptitude. The three "abilities" factor scores do not seem useful for our purposes and will not be used further in the study. The facilities measures seem to be moderately good measures of school quality, with the curriculum measures being the most consistent. Of the facilities measures, only that for curriculum is used below. It would seem that the English Language Factor is not a good measure of school quality while that the Mathematics probably is, although this is less than certain.

Finally, it is to be reiterated once more that no claim is being made that these assertions have been "established" in any rigorous sense but only that they are suggested by the hypothetical and empirical discussions above.

III

EXPENDITURE AND SIZE RELATIONSHIPS

The remainder of the study will deal with various aspects of the expenditure-performance and the size-performance relationships, as well as some discussion of the model. This section includes the general findings for expenditure and size for seven performance variables while the next section will deal with the effect of having the intelligence and socio-economic variables in the multiple regression equation. Subsequent sections will then deal with various aspects of the size and expenditure influences in more detail.

General Summary: Expenditure

Table 4 contains the expenditure findings for grades 9 and 12, respectively. Before the information in that table is summarized, a word is necessary concerning the construction of the expenditure figure itself. The Project Talent Questionnaire asked school principals to supply two figures, the expenditure-per-pupil figure for their school district and the same figure for their own high school. While the latter figure would be the better of the two for this study,[33] it is the former that is being used, for two reasons. First, only three-quarters of the principals who supplied the district figure also supplied the school figure. Second, of those that supplied both figures, a great majority listed the same figure in both places.[34] Both these facts confirm to the author what he has also learned in earlier work: An accurate figure for per-pupil expenditure for individual school plants is extremely difficult to obtain. Thus, since the value of information to be gained by using the school figure was doubtful and the loss of information quite large, it was decided to use the district figure, which is used in all the findings that follow.

Turning now to Table 4, the information there can perhaps be summarized into the following general conclusions concerning the expenditure-performance relationships in the Project Talent High Schools:

1. The relationship of high school expenditure to pupil performance and curriculum is in most instances disappointingly weak. If expenditure-per-pupil can be taken as a rough indicator of the "goodness" of high schools, then it would seem that high school "goodness" does not affect pupil performance nearly as much as we would perhaps prefer to see. This finding will be qualified somewhat below, however, in the discussion of the role of the intelligence variable in the educational model being used.

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[33] In some large school districts the expenditure-per-pupil figure undoubtedly varies from high school to high school.

[34] The coefficient of correlation between the two for the public schools was in excess of .95.

TABLE 4

RELATIONSHIP OF HIGH SCHOOL EXPENDITURE PER PUPIL TO SEVEN MEASURES OF SCHOOL QUALITY, FOUR SOCIO-ECONOMIC QUARTILES AND ALL PUPILS TOGETHER, GRADES 9 AND 12.

TESTS	GRADE 9					GRADE 12				
	S-E 1	S-E 2	S-E 3	S-E 4	All Pupils	S-E 1	S-E 2	S-E 3	S-E 4	All Pupils
English	0.013 (0.22)	0.065 (1.18)	0.090 (1.94)	0.177 (3.97)	0.098 (3.47)	-0.010 (0.17)	0.040 (0.82)	-0.017 (0.38)	-0.079 (1.87)	-0.049 (2.19)
Mathematics	0.050 (0.91)	0.110 (2.06)	0.175 (3.99)	0.182 (4.27)	0.128 (6.64)	0.129 (2.27)	0.051 (1.05)	0.030 (0.68)	0.028 (0.67)	0.100 (3.31)
General School Aptitude	0.047 (0.91)	0.075 (1.51)	0.138 (3.36)	0.195 (4.94)	0.175 (6.38)	0.103 (1.98)	0.065 (1.50)	0.026 (0.67)	-0.009 (0.25)	0.050 (2.21)
General Technical Aptitude	0.003 (0.06)	0.093 (2.07)	0.138 (3.37)	0.150 (4.24)	0.178 (6.15)	0.073 (1.38)	0.029 (0.64)	0.082 (1.98)	0.066 (1.72)	0.112 (3.91)
English Factor	0.040 (0.58)	0.002 (0.03)	0.068 (1.33)	0.136 (2.87)	0.034 (0.90)	-0.036 (0.58)	0.043 (0.80)	-0.050 (1.01)	-0.089 (1.92)	-0.099 (2.96)
Mathematics Factor	0.018 (0.37)	0.092 (1.62)	0.062 (1.23)	-0.014 (0.30)	-0.043 (1.23)	0.173 (2.89)	0.050 (0.93)	0.045 (0.91)	0.039 (0.82)	0.034 (0.99)
Curriculum Measure	0.134 (2.56)	0.107 (2.44)	0.091 (2.35)	0.083 (2.28)	0.074 (2.31)	0.132 (2.72)	0.098 (2.30)	0.084 (2.22)	0.062 (1.79)	0.07. (2.55)
Number of Schools	233	348	428	491	589	301	396	464	516	636

NOTES: See next page.

Notes, Table 4

Beta Coefficients

A beta coefficient is defined as the relative number of standard deviations of the dependent variable associated with a change of one standard deviation of the independent variable.

Statistical Significance

* = Significant at 95%

** = Significant at 99%

See also the notes to Table 1, page 16.

Other Variables in the Multiple Regression Equation

The beta coefficients are net of the effects of pupil intelligence, pupil socio-economic background, and high school size. See also the detailed discussion of the model on pages 33-43.

2. High-school expenditure seems to be much less related to pupil performance in the 12th grade than in the 9th grade, a result which is difficult to explain. Again, this finding will be qualified below in the discussion of the effect of the intelligence variable because co-varying for intelligence reduces the apparent importance of expenditure much more in grade 12 than in grade 9.[35]

3. The relationship of the expenditure variable for the average scores of all pupils taken together is consistently stronger than that for the individual socio-economic quartiles. This would indicate perhaps that what seems to be the influence of expenditure for all pupils taken together is in fact explained to some extent by socio-economic differences.

4. The traditional tests are more related to expenditure than the factor scores.

5. The curriculum measure is consistently and significantly related to expenditure per pupil, although the effect is not nearly as large as that for size (see below).

6. An interesting difference exists in the relationship of expenditure to the performance of pupils from varying socio-economic backgrounds between grades 9 and 12. In grade 9 the relationship becomes stronger as the socio-economic background goes lower, while in grade 12 the relationship is strongest for pupils in the top quartile. This situation could be the result of drop-outs.[36]

7. The difference pointed out in (6) is even more striking with the English scores, which are both increasingly significant positively as socio-economic level becomes lower in grade 9 and increasingly significant <u>negatively</u> as socio-economic level decreases in grade 12.

8. In light of the observation made above that the Mathematics Factor score might be a relatively good measure of school quality, the poor relationship between expenditure and the Mathematics Factor score is disappointing.

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[35]One big difference between grades 9 and 12 is of course drop-outs. But it seems logical that there would be relatively few drop-outs in the top two socio-economic quartiles and it is precisely here that the differences in expenditure-performance relationship between the two grades is greatest.

[36]Thus, if there were a great many poorly performing pupils in low-expenditure schools, this would help to make the expenditure-performance relationship seem strong. But by the time of grade 12, many of these poorly performing pupils have dropped out which raises the average score disproportionately more for the lower spending schools. One way to allow for this is to use the performance of individual pupils and to co-vary for the individual socio-economic backgrounds of each. This is done below.

9. It would be helpful to discuss in somewhat more detail the relative magnitudes of the effects shown in Table 4. Except for the curriculum measure, the magnitudes are much greater in the 9th grade. One standard deviation of the expenditure-per-pupil variable for the high schools represented in Table 4 is in the neighborhood of $90.00. (This varies, of course, with the individual regression, since each population used had differing numbers of missing observations.) For convenience, we can use the slightly conservative figure of $100.00 for the standard deviation.[37] The beta weights given represent the number of standard deviations of the dependent variable which are associated with one standard deviation of the independent variable. Thus, for example, the effect of $100.00 additional expenditure per pupil in pupil performance on the Mathematics score, grade 9, is (with the exception of the top S-E quartile) between 0.1 and 0.2 standard deviations, or in this instance about one additional question correct on a test where average correct answers number about 20. Alternatively, since one standard deviation (if we are speaking of schools not extremely far from the mean) is associated with advancing about 34 percent in the ranks of all schools, then the additional $100.00 per pupil is associated with additional performance equal to increasing school rank between 3 and 6 percent.

General Summary: Size

The size variable used is number of pupils in average daily attendance (ADA). While there is a slight problem connected with the use of ADA because of differences in absentee rates, it is nonetheless quite adequate for our purpose here, which is merely to have a reasonably accurate measure of overall school size.

Size findings for the seven key output measures are given in Table 5 in format identical to that in Table 4. The following points summarize the size findings.

1. In general the relationship of high school size to high school performance, net of the effects of pupil intelligence, pupil socio-economic background, and high school expenditure-per-pupil, is negative at meaningful levels of statistical significance. This is not true for the curriculum measure, however.

2. The relationship of size to breadth of high school curriculum (and also number of special and total facilities, not shown) is highly positive at extremely high levels of significance. It would appear that size of institution accounts for a great majority, but not all, of additional facility and course offerings. Since increase in size is otherwise associated in general with decrease in performance, the investigator must be extremely wary in using curriculum and facilities as

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[37] The range of observations was from about $50.00 to about $1100.00 per pupil. The mean expenditure for the public schools (with some missing observations), grade 9, was $507.75.

TABLE 5

RELATIONSHIP OF HIGH SCHOOL SIZE AS MEASURED BY PUPILS IN AVERAGE DAILY ATTENDANCE
TO SEVEN MEASURES OF SCHOOL QUALITY, FOUR SOCIO-ECONOMIC QUARTILES AND ALL PUPILS TOGETHER, GRADES 9 AND 12.

	GRADE 9					GRADE 12				
TESTS	S-E 1	S-E 2	S-E 3	S-E 4	All Pupils	S-E 1	S-E 2	S-E 3	S-E 4	All Pupils
English	-0.079 (1.33)	-0.083 (1.58)	-0.019 (2.41)*	-0.082 (1.87)*	-0.094 (3.35)**	-0.008 (0.13)	-0.072 (1.48)	-0.083 (1.82)*	-0.216 (5.08)**	-0.109 (4.08)**
Mathematics	-0.218 (4.06)**	-0.172 (3.37)**	-0.174 (4.05)**	-0.154 (3.70)**	-0.196 (6.07)**	0.027 (0.48)	-0.087 (1.79)*	-0.097 (2.19)*	-0.152 (3.58)**	-0.088 (2.85)**
General School Aptitude	-0.155 (3.08)**	-0.127 (2.67)**	-0.162 (4.02)**	-0.135 (4.94)**	-0.148 (4.94)**	0.006 (0.11)	-0.098 (2.26)*	-0.106 (2.68)**	-0.213 (5.73)**	-0.103 (4.43)**
General Technical Aptitude	-0.201 (4.11)**	-0.175 (4.07)**	-0.260 (6.49)**	-0.278 (8.03)**	-0.276 (9.68)**	-0.108 (2.09)*	-0.246 (5.40)**	-0.236 (5.70)**	-0.229 (5.85)**	-0.227 (7.74)**
English Factor	-0.031 (0.46)	0.019 (0.34)	-0.043 (0.87)	0.0007 (0.02)	-0.048 (1.28)	-0.015 (0.25)	0.028 (0.53)	-0.020 (0.39)	-0.150 (3.22)**	-0.085 (2.48)**
Mathematics Factor	-0.182 (2.76)**	-0.175 (3.21)**	-0.053 (1.06)	-0.079 (1.68)*	-0.116 (0.86)	0.031 (0.53)	-0.095 (1.79)*	-0.016 (0.33)	0.113 (2.36)*	-0.026 (0.73)
Curriculum Measure	0.621 (12.23)**	0.599 (14.37)**	0.580 (15.32)**	0.553 (15.58)**	0.629 (19.93)**	0.584 (12.84)**	0.562 (13.33)**	0.562 (14.76)**	0.566 (16.20)**	0.599 (19.06)**
Number of Schools	233	348	428	491	589	301	396	464	516	636

NOTES: See next page

Notes, Table 5

Beta Coefficient

A beta coefficient is defined as the relative number of standard deviations of the dependent variable associated with a change of one standard deviation of the independent variable.

Statistical Significance

* = Significant at 95%

** = Significant at 99%

See also the notes to Table 1, page 16.

Other Variables in the Multiple Regression Equation

The beta coefficients are net of the effects of pupil intelligence, pupil socio-economic background, and high school expenditure per pupil in average daily attendance. See also the detailed discussion of the model on pages 33-43.

a quality measure unless he has gone to great pains to account for size.[38]

3. The negative size-to-performance relationship seems somewhat more pronounced for children in the lower two socio-economic quartiles and in the 9th grade as opposed to the 12th.

The Model in More Detail: The Effect of the Intelligence and Socio-Economic Variables Upon the Findings

Having given this general introduction of the size and expenditure findings of the study (the reader is reminded that more detailed discussion below may alter the thrust of some of the above), it is necessary, before pursuing the expenditure and size findings in more detail, to pause momentarily for some further discussion of the model.

The Analytical Model: Theoretical Discussion

The model which was used in the discussion above was of the form

$$Y_i = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e$$

where

Y_i is the measure of quality, and

X_1 = Verbal Knowledges Factor score (intelligence)

X_2 = expenditure-per-pupil in ADA

X_3 = high school size in ADA

X_4 = average value of the socio-economic index for pupils in the population for which Y is applicable.

e = an error term.

For all but the curriculum and facilities measures, this model was fitted to pupils from similar socio-economic backgrounds.

The basic reasoning standing behind this simple model was already discussed to some extent above. The effect of school resources upon educational quality can only be examined after pupil ability and school environmental differences are accounted for. One "environmental" characteristic, in the sense that it is not within the control of the school administrators, is school size.

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[38]Some investigators (e.g., Schmandt and Stevens) have based arguments for economies of scale on results such as those in (2), a conclusion that is shown to be obviously untenable by the findings in (1).

There does not exist enough space in this study to critically discuss this model in as much detail as the subject warrants. However, it will be instructive to discuss the problems involved in accounting for differences in pupil ability and in school "environment."

School Performance and Pupil Ability

The criticism to which the model is most vulnerable is that the use of a variable to control for pupil intelligence in fact removes some of the variance for which the school itself is responsible. Or to put it differently, the formal education process is itself responsible for some of the performance of pupils on I.Q. tests. Two points are pertinent to this criticism. First, as everyone knows, there is no measure that shows native ability exactly. All intelligence tests include achievement at least to some extent, and one educational psychologist, Cronbach,[39] cites two studies where the overlap between intelligence and achievement is 59 percent and 71 percent, respectively, although he goes on to say that this is higher than the correlation found between the most commenly used test (the Stanford-Binet) and achievement. Insofar as such overlapping exists the criticism stated above is correct and the model understates the relationship of expenditure to performance.

The second point is that there is such a thing as innate learning ability along with a long tradition concerning its measurement. Any model which did not make the attempt--imperfect though it may be--to allow for this would be most naive. Indeed, this tradition is so widely accepted that educational psychologists would not consider the findings for any study which failed to control for intelligence as meaningful. Finally, it should be added that the Project Talent measure of intelligence is a relatively good one. It is improbable that the overlap between the Verbal Knowledges Factor score and the performance measures is anything like the magnitudes in the two studies mentioned by Cronbach.

To summarize the discussion with respect to the place of a native ability variable in the model, then, the presence of the Verbal Knowledges Factor score in the regression equation undoubtedly biases the effect of formal schooling downward (potentially how much downward will be examined in a moment), although omitting the variable would probably introduce an opposite error of even greater magnitude. Omitting and including the intelligence variable undoubtedly provides the extreme values between which the true value is to be found.

School Performance and School Environment

An even more intractable problem attends any attempt to hold school environmental factors constant. In searching for a variable to represent pupil native ability, there is at least no doubt concerning the thing

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[39] Lee J. Cronbach, Essentials of Psychological Testing, 2nd edition, New York, Harper and Brothers, 1960, page 224.

sought, while meaningful factors influencing school environment may run into the hundreds. How should one even begin to hold environmental differences constant?

Obviously, any complete accounting for environmental differences is impossible. On the other hand, it is true that the important environmental differences which should be held constant are all highly related to the socio-economic status of the people who live in the particular school district. There is a great wealth of evidence to show the close relationship to pupil performance of such variables as income, educational level of parents, wealth, and occupation of parents. Indeed, all of these variables are highly related to pupil performance and to each other,[40] and it is this fact, in the author's opinion, which makes the isolation of environmental differences feasible. If it is possible merely to construct a good measure of the socio-economic status of each pupil's family, the environment problem is to an important extent, solved. Fortunately, Project Talent has an excellent socio-economic (S-E) measure for each pupil, consisting of the sum of eight characteristics, each weighted equally. These are: value of home, family income, number of books in the home, number of appliances in the home, number of high-cost appliances in the home, amount of study space enjoyed by the pupil, father's occupation, father's education, and mother's education. Use of this index should give an excellent although not perfect accounting of environmental differences and therefore it has been made a part of the basic model.

But there is more to be said concerning the socio-economic influence. The reader will have noticed by now that S-E is in fact accounted for <u>twice</u>, once by using the S-E index as one of the continuous variables in the multiple-regression equation and secondly by stratifying the pupils into quartiles according to the same socio-economic index. Doesn't this procedure over-compensate for differences in socio-economic environment?

The justification for using the socio-economic variable in this way involves the fact that there are two separate effects (both working primarily on motivation) of socio-economic differences--an individual effect and an aggregate effect. The individual effect involves the pupil's relationship with his own family, e.g., highly educated parents create pressures upon their children in many subtle ways with the end result that the pupil is highly motivated to learn. The aggregate effect involves what motivation is obtained by the pupil from his classmates. If a pupil's classmates are highly motivated toward learning, a certain amount of this will be translated to the pupil. In the present analytical scheme the introduction of the continuous variable is meant to capture the aggregate, or "classmates," effect, while stratification is meant to capture the individual, or "parents," effect.

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[40]Almost all the literature given reference to above points this out. See especially the studies by Burkhead, Coleman, and the Joint Economic Committee paper by the author.

Finally, a word should be mentioned concerning the role of school size in all this. Size is a kind of "environmental" variable which is of particular interest to economists who, as indicated in the introduction above, are interested in seeing if anything can be learned concerning the important issue of optimum school size. The size variable is properly considered as one of the unknowns in the model, therefore, although its inclusion may possibly capture environmental effects which should be captured, even though investigators find themselves at a loss to understand their exact causes.

Empirical Findings Concerning the Effect of the Intelligence and Socio-Economic Variables

To provide further explication of the role of the intelligence and socio-economic variables in the model, in Tables 6 and 7 the intelligence and socio-economic variables are "stepped-in" the multiple regression model for seven quality measures (all pupils) to demonstrate their effects upon expenditure and size. Further findings concerning the impact of intelligence and S-E are given below in the discussion of dummy variables.

Taking the effect of the two variables upon expenditure first, three general conclusions are possible. First, the expenditure-performance relationship is affected much less by intelligence and S-E for the traditional scores than for the factor scores. The only exception to this is the English score in grade 12. Secondly, the impact of intelligence and S-E is greater in the 12th grade than in the 9th. Finally, the relationship of expenditure to school curriculum, size being held constant, is not affected much by the two variables.

The result concerning traditional versus factor scores is somewhat curious in light of the hypothesis presented above that traditional scores overlap with intelligence to greater degree than do factor scores. On the other hand, it should be recalled that the English and Mathematics Factor scores are constructed from residual variance left in the data _after_ the Verbal Knowledges Factor has been removed. This being true a good case can probably be made for not including the Verbal Knowledges Factor score in the explanatory equations for the factor scores. Doing this does not change the significance of the expenditure variable very much, however, since the Verbal Knowledges Factor score is highly colinear with the socio-economic index.

Because of the hypothesized overlapping between the traditional scores and intelligence, it would be instructive to consider the ramifications of including the intelligence variable in the regression equation for these measures a little more carefully. In Table 8 are presented some figures showing the relative size of the beta weights and t-values with intelligence in and out of the equation for two of the traditional measures. Notice that the introduction of the intelligence variable has much more impact upon the expenditure relationships for all pupils taken together than when they are broken into quartiles by socio-economic background. Average figures for percentage changes

TABLE 6

VALUE OF THE t-STATISTIC FOR COEFFICIENTS OF NET REGRESSION FOR VARIABLES IN THE SCHOOL EXPENDITURE MODEL ENTERED IN VARIOUS COMBINATIONS WITH APPLICABLE COEFFICIENTS OF MULTIPLE DETERMINATIONS, ALL PUPILS, GRADE 9

Test	Explanatory Variables				
	Expenditure	Size	I. Q.	S-E	R^2
English	5.76	-0.72			.050
	3.29	-3.42	23.12		.503
	4.18	-2.53		24.56	.531
	3.47	-3.35	7.70	9.93	.574
Mathematics	8.29	-3.44			.103
	6.61	-6.13	17.91		.420
	7.24	-5.01		15.43	.361
	6.64	-6.07	8.48	3.48	.430
General School Aptitude	7.89	1.88			.091
	6.27	-5.51	26.22		5.82
	6.99	-3.86		21.78	.497
	6.38	-5.45	12.38	5.45	.601
General Technical Aptitude	7.84	-5.02			.104
	6.15	-9.69	24.59		.559
	6.73	-7.01		16.20	.381
	6.15	-9.68	15.36	-0.15	.558
English Factor	2.57	-0.51			.006
	0.91	-1.49	9.09		.128
	0.78	-1.39		13.24	.234
	0.90	-1.28	-1.10	9.07	.234
Mathematics Factor	1.34	-1.80			.002
	-1.06	-3.39	13.02		.225
	-1.14	-3.26		17.30	.338
	-1.23	-3.32	0.86	10.05	.338
Curriculum Measure	3.00	20.04			.443
	2.32	19.75	3.33		.452
	2.32	20.03		4.29	.459
	2.31	19.93	0.03	2.68	.458

NOTES: See next page.

Notes, Table 6

Table Format

In this table the beta coefficients of net regression are not included but their applicable values of the t-statistic are. The sign given for the t-statistic is the correct sign for the applicable beta coefficient of net regression.

Number of Observations

The number of high schools for which the data in Table 6 are applicable is 589.

Statistical Significance

Value of t	Significance Level
1.96	95%
2.59	99%

R^2

The coefficient of multiple determination is corrected for degrees of freedom lost.

TABLE 7

VALUE OF THE t-STATISTIC FOR COEFFICIENTS OF NET REGRESSION FOR VARIABLES IN THE SCHOOL EXPENDITURE MODEL ENTERED IN VARIOUS COMBINATIONS WITH APPLICABLE COEFFICIENTS OF MULTIPLE DETERMINATIONS, ALL PUPILS, GRADE 12

	Explanatory Variables				
Test	Expenditure	Size	I. Q.	S-E	R^2
English	1.98	2.43			.016
	-2.54	-4.37	29.39		.584
	-0.32	-2.34		35.01	.665
	-2.19	-4.80	11.23	17.59	.720
Mathematics	5.46	2.29			.062
	3.00	-2.95	21.59		.459
	4.77	-0.53		17.96	.378
	3.31	-2.85	11.14	5.04	.479
General School Aptitude	4.85	2.95			.059
	1.62	-4.42	33.84		.665
	4.32	-0.73		27.20	.566
	2.21	-4.43	17.41	9.49	.706
General Technical Aptitude	6.09	-0.72			.052
	3.73	-7.78	25.13		.525
	5.54	-4.14		17.85	.369
	3.91	-7.74	14.84	3.04	.531
English Factor	-1.01	0.50			.000
	-3.22	-2.53	11.31		.165
	-3.26	-2.86		18.97	.360
	-2.96	-2.48	-1.59	14.00	.362
Mathematics Factor	2.44	2.15			.018
	0.39	-0.97	12.05		.200
	1.13	-0.59		17.12	.328
	0.99	-0.73	0.76	10.99	.327
Curriculum Measure	3.32	20.69			.445
	2.48	19.02	4.39		.461
	2.90	19.84		4.17	.459
	2.55	19.06	1.94	1.39	.462

NOTES: See next page.

Notes, Table 7

Table Format

See notes for Table 6, page 38.

Number of Observations

The number of high schools for which the data in Table 7 are applicable is 636.

Statistical Significance

Value of t	Significance Level
1.96	95%
2.59	99%

R^2

The coefficient of multiple determination is corrected for degrees of freedom lost.

TABLE 8

ERCENTAGE INCREASE IN THE MAGNITUDE AND STATISTICAL SIGNIFICANCE OF THE EXPENDITURE ELATIONSHIP TO GENERAL SCHOOL APTITUDE AND GENERAL TECHNICAL APTITUDE WHICH RESULTS HEN THE INTELLIGENCE VARIABLE IS OMMITTED FROM THE MULTIPLE REGRESSION EQUATION FOR OPULATIONS IN WHICH THE RELATIONSHIP IS STATISTICALLY SIGNIFICANT, GRADES 9 AND 12.

	General School Aptitude		General Technical Aptitude	
	Magnitude %	Significance %	Magnitude %	Significance %
Grade 9				
All pupils	82	26	79	28
S-E 1	NS	NS	NS	NS
S-E 2	47	28	61	28
S-E 3	49	30	52	32
S-E 4	43	33	82	47
Grade 12				
All pupils	400	200	128	64
S-E 1	19	5	5	-11
S-E 2	43	100	NS	NS
S-E 3	113	69	54	30
S-E 4	NS	NS	178	138

Notes: See next page.

Notes, Table 8

ns = The computed coefficients of net regression for this population were not statistically significant enough to be meaningful.

have been computed for the significant expenditure-performance relationships for the quartiles and are given in the table. The impact of the intelligence variable is much more erratic in the 12th grade, and in three of the five populations the effect is quite large.

The figures in Table 8 should allow some conclusions concerning the expenditure-performance relationship for these two tests. Thus, we might say that the relationships shown above in Table 4 are minimum values and that, if the hypothesis concerning the overlap of intelligence performance test scores is correct, the true relationship might be as much stronger as the percentages given in Table 8. For example, in Table 4 the beta value for the General School Aptitude test for pupils in the second quartile in grade 9 is 0.075 and its t-value 1.51. This can be interpreted as a minimum value for the relationship with the maximum value being 47 percent greater for the beta coefficient (0.110) and 28 percent for the value of the t-statistic (1.92). Thus, if the model is at all correct, the true value for the relationship falls somewhere between these two.

Turning to the size relationship, the effect of the intelligence and socio-economic variables is to make it more negative and more significant. In point of fact, many of the negative size findings in the study depend upon the presence of the intelligence variable in the model as the reader can see in Tables 6 and 7. This seems to be more often true for the grade 12 populations than the grade 9 ones. As a rule of thumb with respect to the measures of performance used in Tables 6 and 7, the deletion of intelligence from the regression equation would lower both the strength and statistical significance of the negative effect to about one-half. However, for several of the measures, especially in grade 9, the introduction of either intelligence or S-E changes the relationship from one that is significantly positive to one that is significantly negative. The fact that either environmental factor will cause this result makes the negative relationship much more believable, at least to the author.

The Expenditure-Performance Relationship in More Detail: Individual Pupils Used as Observations

Having completed the discussion of the model itself, we are finally in a position to analyze the expenditure-performance and size-performance relationships much more carefully. In this section will be presented findings obtained when using individual pupil performance as the unit of observation and breaking the size and expenditure variables into categories to be represented as dummy variables.

The use of dummy variables involves a simple technique in which one variable is introduced to measure the presence or absense of a particular quality. If the quality in question is present, this is denoted simply by listing the value of the variable as 1.0. If it does not have that quality, the value of the variable is zero. When a dummy variable is entered as a variable in a multiple regression equation, the value of the computed b-weight will indicate the amount of the dependent variable that is associated with the one particular quality being represented by the dummy variable. For example, if the dependent variable were rainfall, the dummy variable might be "summer" and the value of rainfall beyond some average figure for a certain region in the summer is +18.0 inches, etc.

In the present study, dummy variables have been used extensively to represent intervals in the expenditure and size functions, the purpose being to find the exact functional relationships that exist in the data between these two variables and the various measures of performance. The expenditure range was broken into 20 discrete intervals and a dummy variable made of each interval; the corresponding number of intervals for the size relationship is 45. The values of these intervals will become clear to the reader as he examines the individual charts which contain the dummy variable findings.

The procedure of using the individual pupil as the unit of observation has one key advantage and (at least potentially) one key disadvantage. The advantage is of course that the approach yields a great deal more information. In the Project Talent 10 percent sample of pupils in grades 9 and 12, which is what was utilized here, there are between five and six thousand pupils which are useful observations after the deletion of missing observations. The benefit of having all this information, especially from the standpoint of using dummy variables, is obvious.

The potential drawback has to do with bias introduced because the number of observations (pupils) for each school is not equal. This is acceptable so long as the model itself is not misspecified with respect to school attributes (as opposed to pupil attributes). Thus, if the unit of observation were individual schools in such a situation, it might be that the misspecification is absorbed in random fashion in the error term. But when the change is made to individual pupils as observations, the misspecification can no longer result in random errors since the error terms of the larger schools assume relatively greater importance. This problem could be enhanced if the misspecification were related to school size in the first place, although this more systematic bias should be removed from the regression equation by the introduction of the size variable.

It would appear that this potential bias is not important, however. Table 9 contains comparative data for the General School Aptitude score using both approaches and there seems to be little systematic difference between the Beta coefficients of net regression and the computed t-statistics whether the computation is made for schools or pupils with the unimportant exception that the values of t are somewhat greater for the latter. Findings obtained using both approaches would seem to be directly comparable.

TABLE 9

COMPARATIVE BETA COEFFICIENTS OF NET REGRESSION AND VALUES OF THE t-STATISTIC WHEN THE UNITS OF OBSERVATION ARE SCHOOLS AND INDIVIDUAL PUPILS, EXPENDITURE PER PUPIL AND SCHOOL SIZE RELATIVE TO GENERAL SCHOOL APTITUDE SCORE, FOUR SOCIO-ECONOMIC QUARTILES, GRADE 12

	High Schools			Pupils		
	Beta	t	N	Beta	t	N
Expenditure						
S-E 1	.118	2.38	301	.110	4.28	1085
S-E 2	.094	2.17	396	.072	3.20	1426
S-E 3	.052	1.35	464	.013	0.72	2350
S-E 4	.022	0.56	516	.019	0.63	834
Size						
S-E 1	.012	0.23	301	-.003	0.11	1085
S-E 2	-.082	1.87	396	-.045	2.01	1426
S-E 3	-.083	2.11	464	-.039	2.23	2350
S-E 4	-.155	4.18	516	-.115	3.84	834

Notes: See next page.

Notes, Table 9

Variables in the Multiple Regression Equation

The multiple regression equation from which these estimates were taken for both schools and pupils has achievement performance dependent upon high school expenditure per pupil, high school size in average daily attendance, and average pupil intelligence (Verbal Knowledges Factor) score.

The central purpose for examining the relationships with dummy variables has been to test for linearity. If the relationships are not linear, this procedure constitutes a powerful device for giving us proper insight into what the correct relationship is. Since this is true, and assuming the relationships are found to be reasonably linear, the actual statistical significance of the individual variables is less important to us than the descriptive information contained in each chart. That is to say, the statistical significance of the size and expenditure variables as they are related linearly to performance is already known from findings presented elsewhere. The dummy variable analysis is meant to show whether these estimates are reliable by testing the degree to which the assumption of linearity is correct.

With apologies to the reader for this long introduction, we may now begin to examine the results which obtain when the continuous variable for high school expenditure-per-pupil is broken into 20 segments which become 20 dummy variables. The values of each individual dummy variable can be read directly from the charts. A suggested way to interpret the lines entered for each dummy variable interval would be as follows: To obtain the predicted value of the performance of the pupils whose schools have expenditure-per-pupil levels falling within the interval, take the beginning value (the value of the computed intercept, shown by the base line in the charts) and algebraically add the value shown. Taking all the values together graphically gives a detailed picture of the functional relationship over the range of the explanatory variable. The lines for each interval must be taken as descriptively accurate even though not significant statistically. Statistical significance means in effect that the dispersion around the mean value for the interval (which represented by the line itself) is relatively small. It is to be noted that not all dummy variables are represented on a given chart; this represents the decision to delete findings for dummy variables representing fewer than 20 pupils as being undependable.[41] The statistical significance of each individual variable is shown on each chart as explained in the notes.

The first 24 charts give the expenditure-performance relationships for the six most important measures (as determined above) in grades 9 and 12. Each finding is given first when the expenditure variable is alone in the regression equation and then when the continuous variables for pupil intelligence, school size, and pupil socio-economic index are also in the equation. These two situations will be referred to below as "gross" and net", respectively. The inclusion of both relationships will give the reader an idea of the limiting values of these important

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[41]This cutoff point was chosen rather arbitrarily. It represents a compromise from the traditional figure of 30 for a "large sample." Due to the potential capriciousness of individual pupil performance on achievement tests, it is highly desirable to have the law of large numbers working at least to this extent.

Chart 1

NINTH GRADE

ENGLISH

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

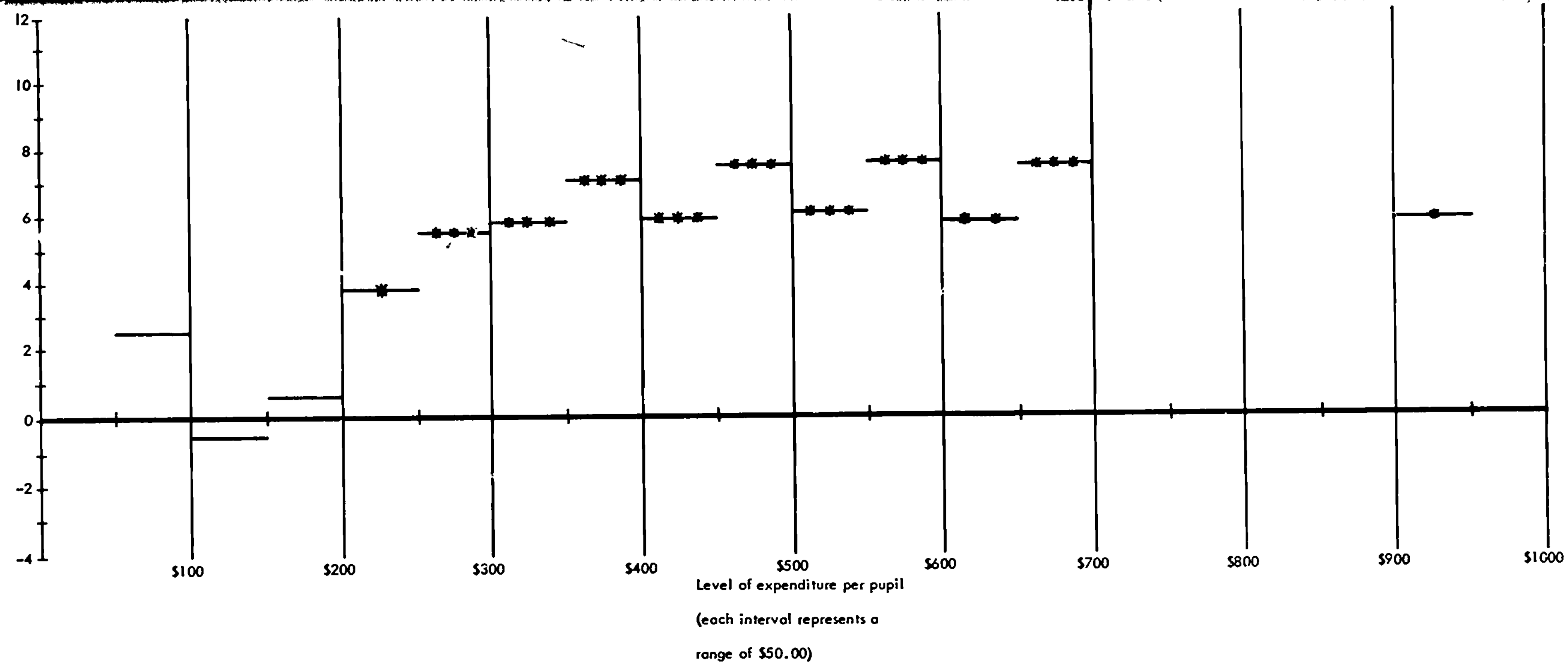
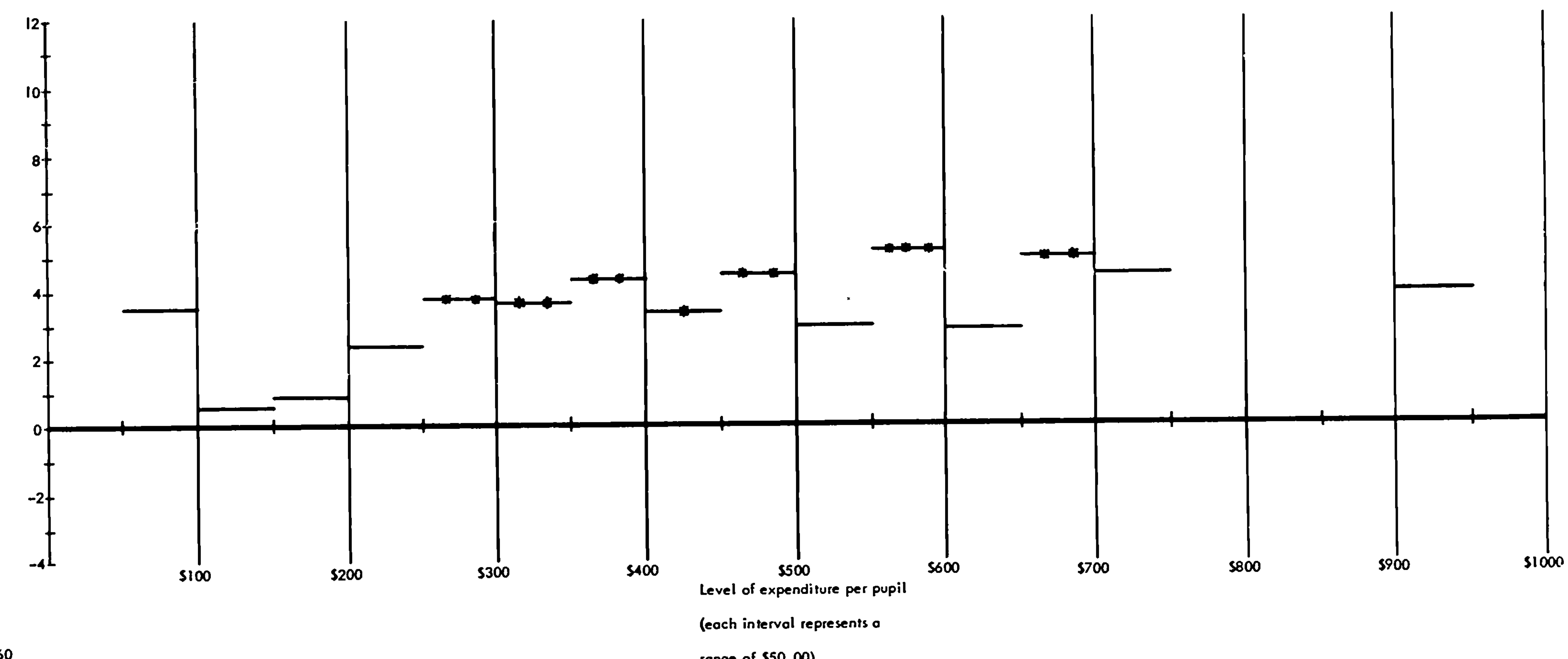


Chart 2

NINTH GRADE

ENGLISH

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 1-24 appear on page 60

NINTH GRADE
MATHEMATICS

(No allowance made for
the effects of intelligence,
socio-economic background,
and high school size)

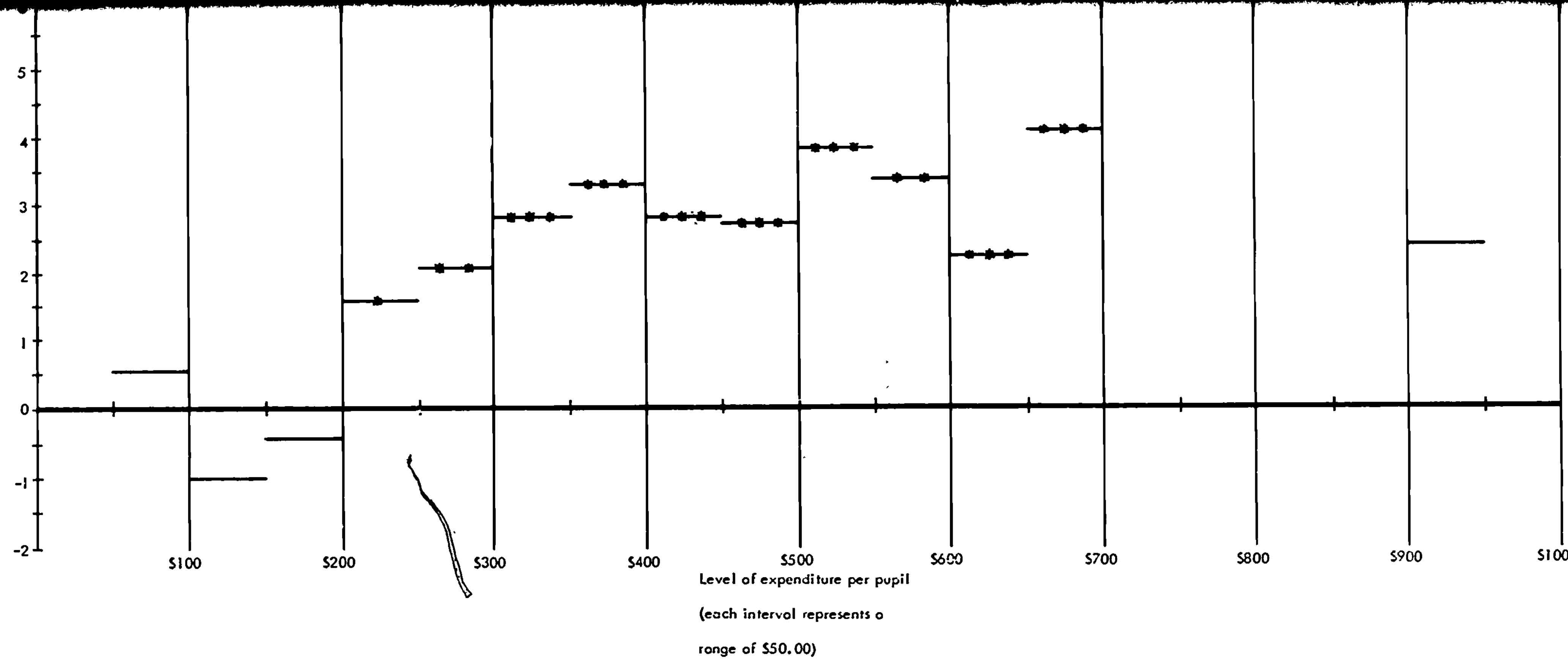
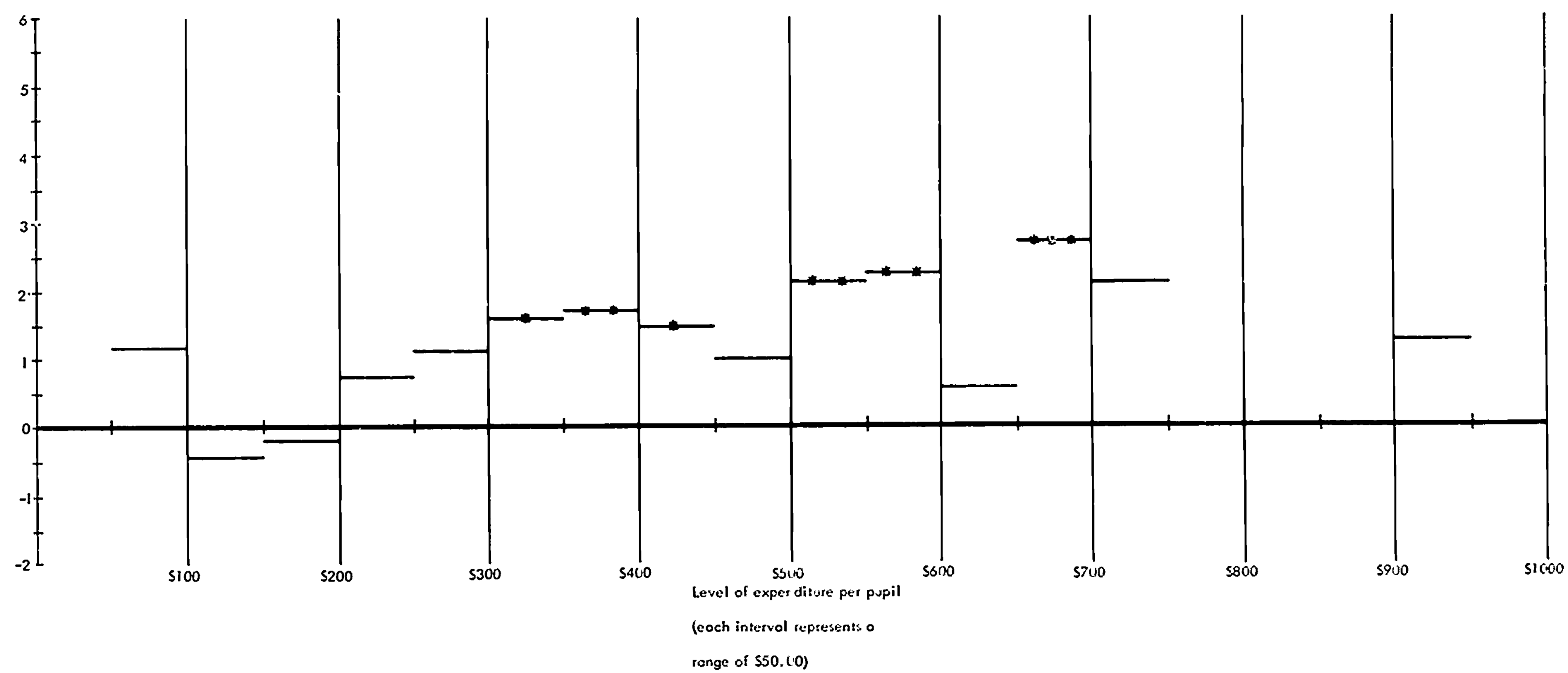


Chart 4

NINTH GRADE
MATHEMATICS

(Net of the effects of intelligence,
socio-economic background,
and high school size)



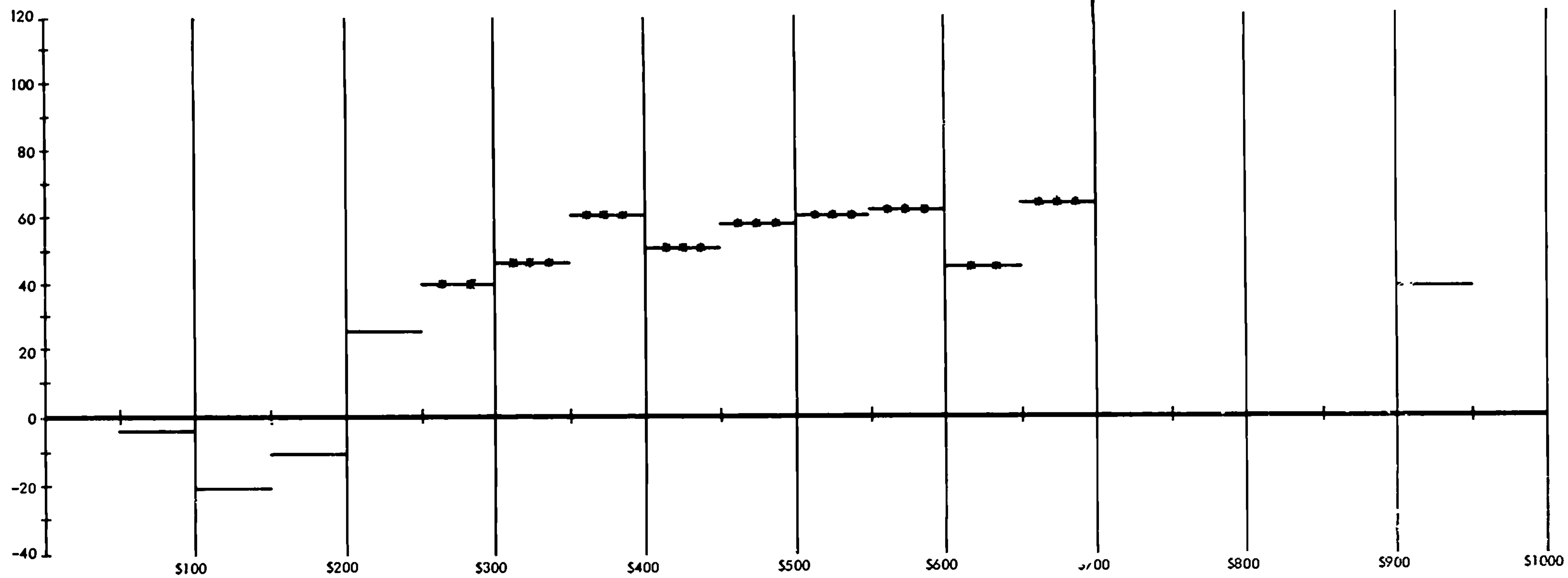
Notes to Charts 1-24 appear on page 60

Chart 5

NINTH GRADE

GENERAL SCHOOL APTITUDE

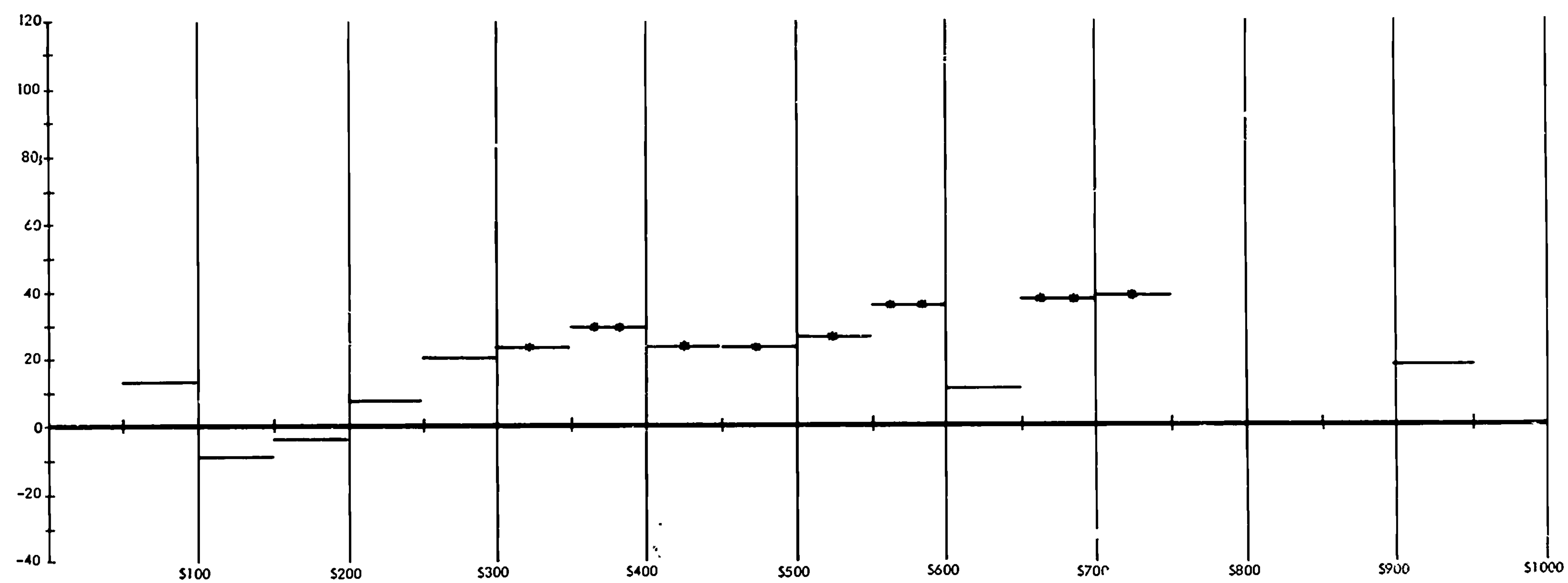
(No allowance made for the effects of intelligence, socio-economic background, and high school size)



NINTH GRADE

GENERAL SCHOOL APTITUDE

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 1-24 appear on page 60

Chart 7

NINTH GRADE

GENERAL TECHNICAL APTITUDE

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

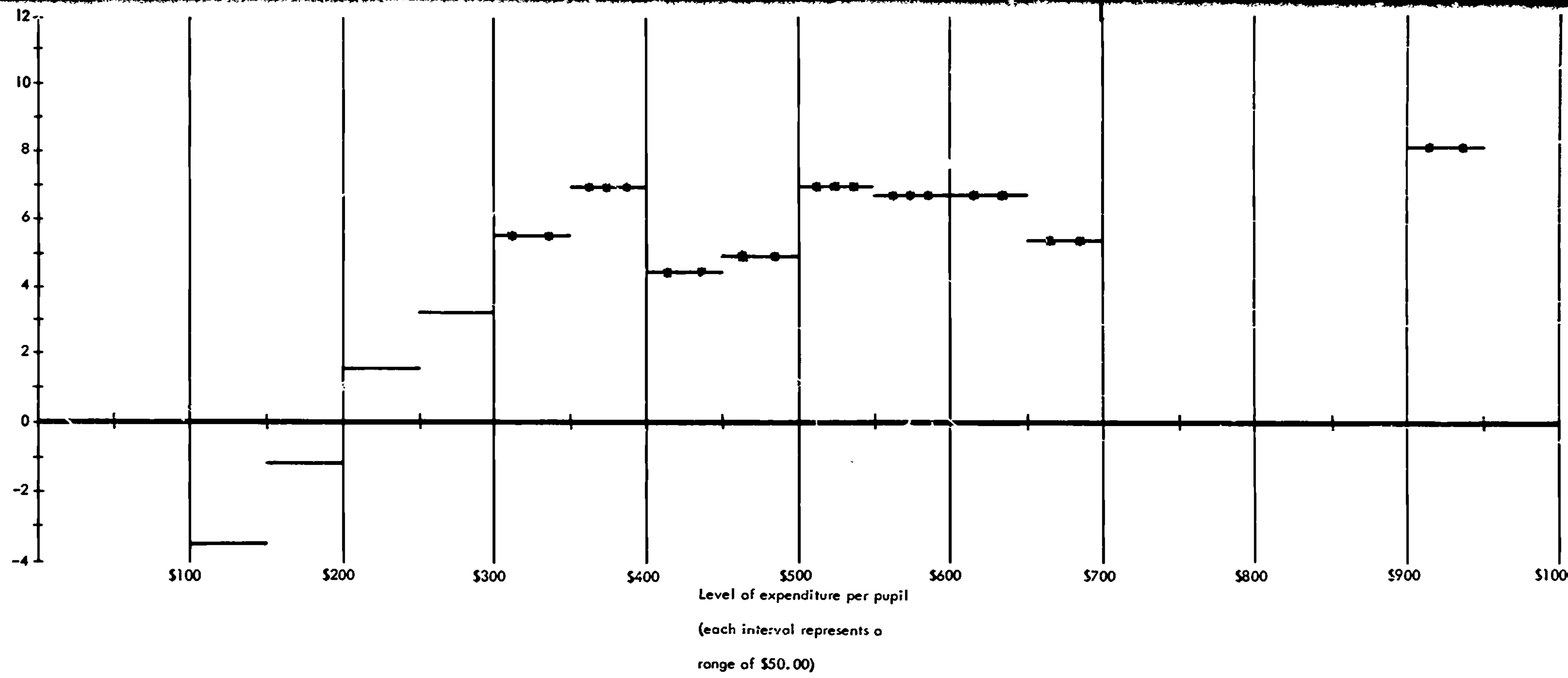
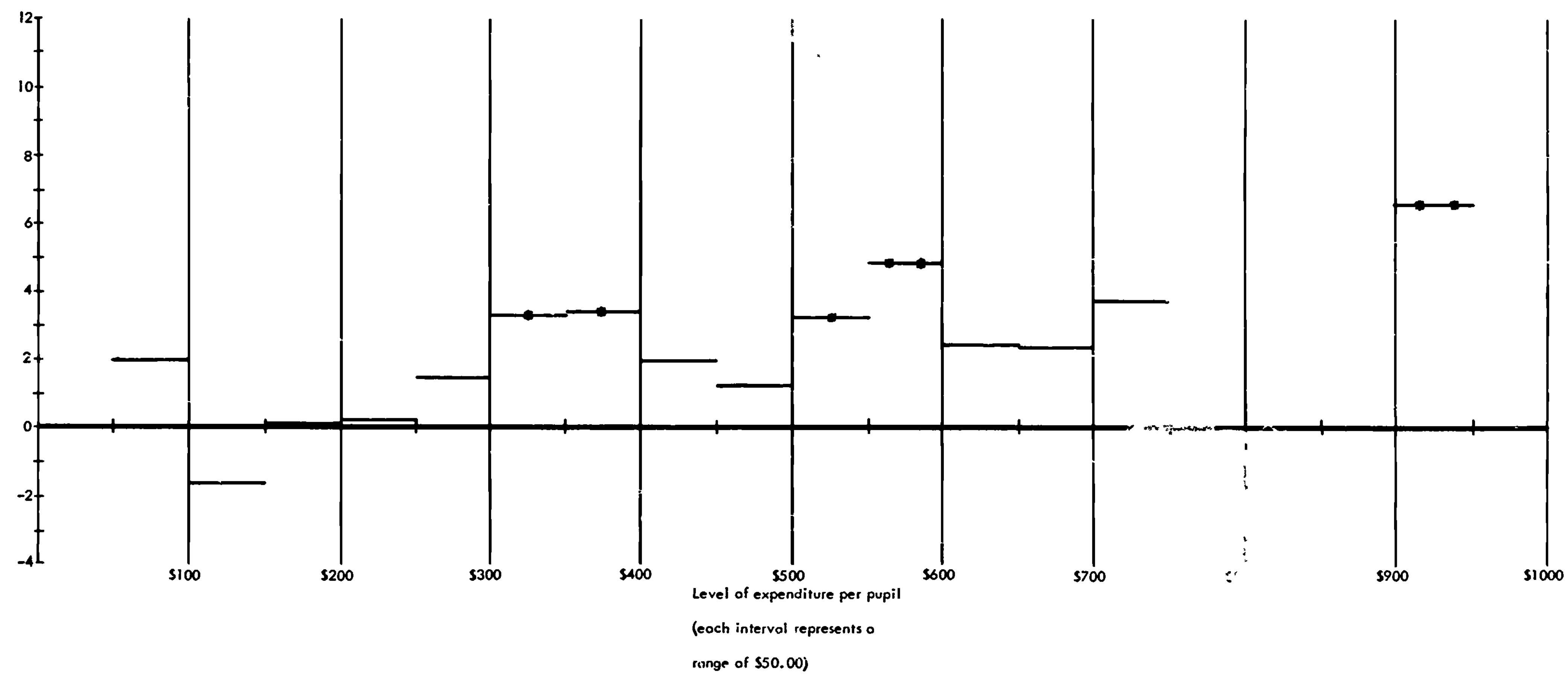


Chart 8

NINTH GRADE

GENERAL TECHNICAL APTITUDE

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 1-24 appear on page 60

Chart 9

NINTH GRADE

ENGLISH FACTOR SCORE

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

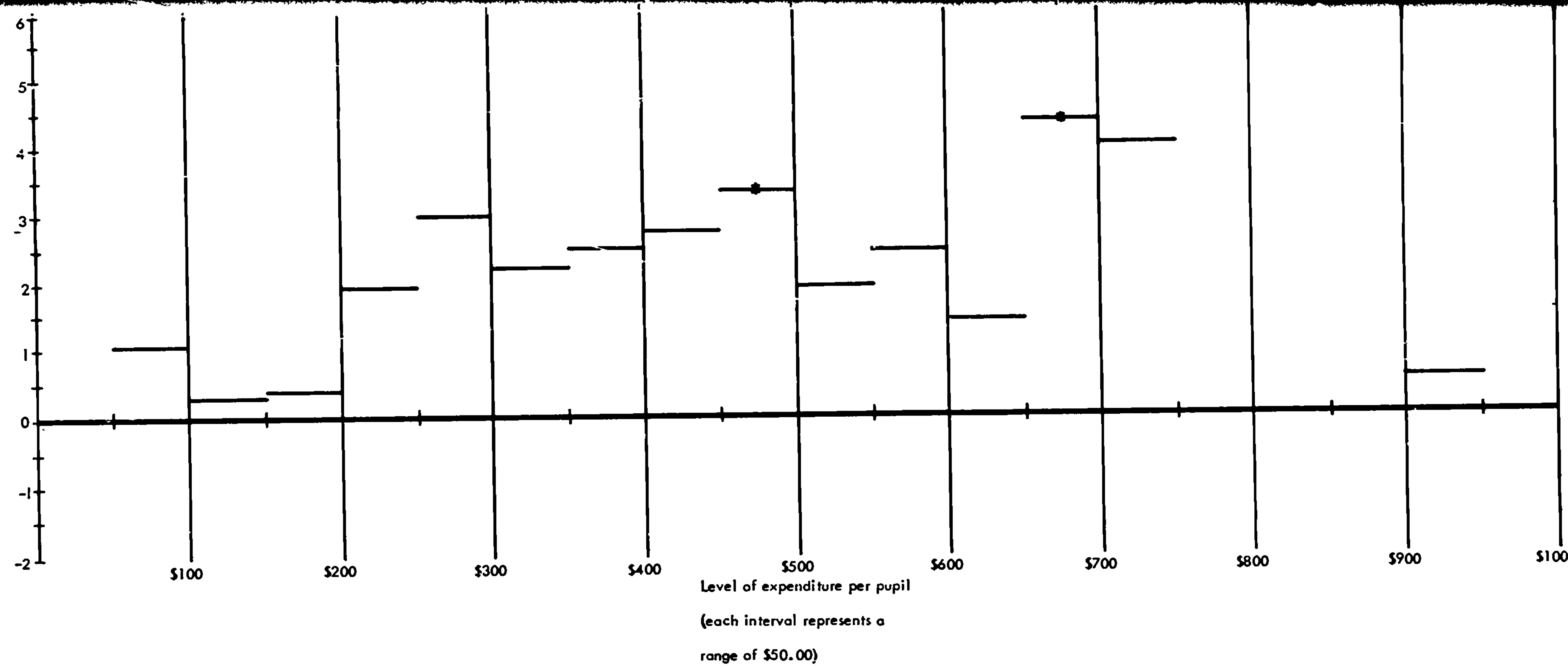
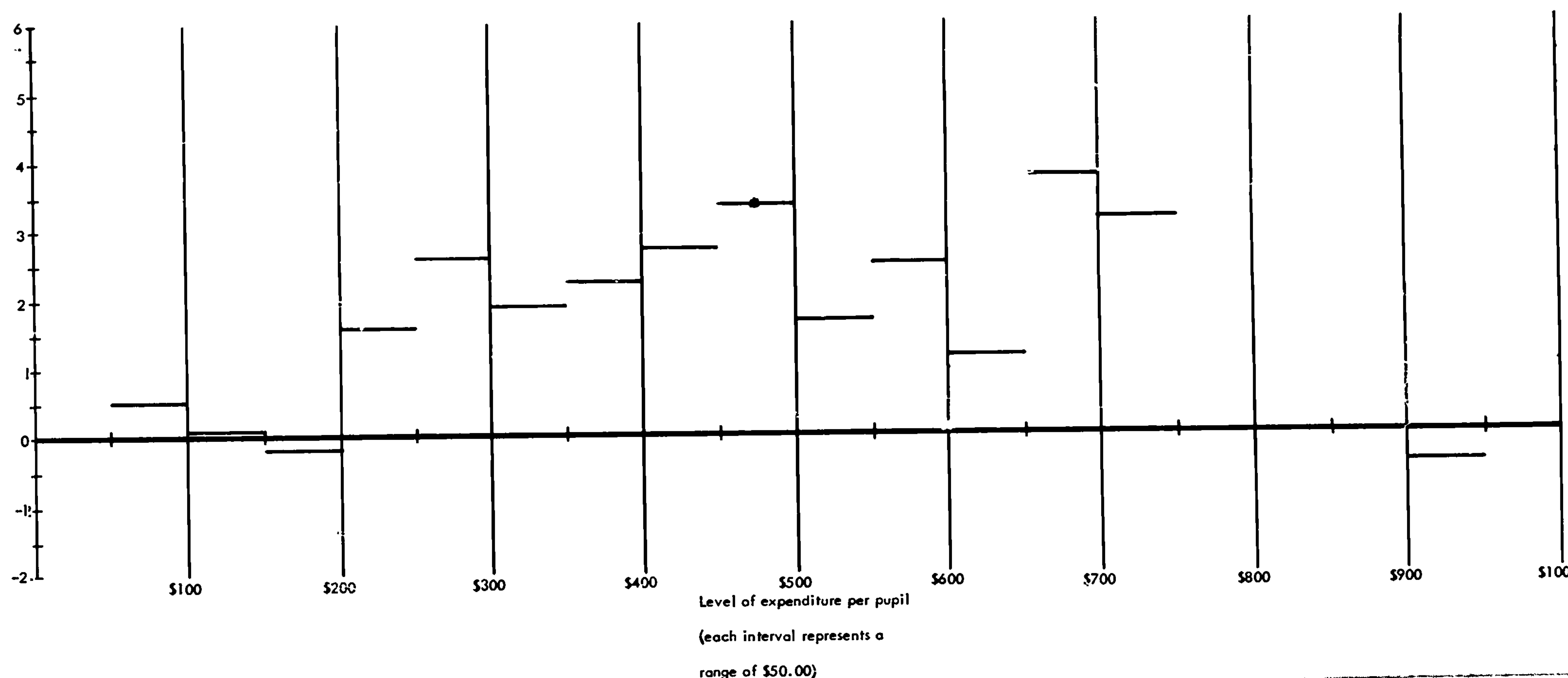


Chart 10

NINTH GRADE

ENGLISH FACTOR SCORE

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 1–24 appear on page 60

Chart 11

NINTH GRADE

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

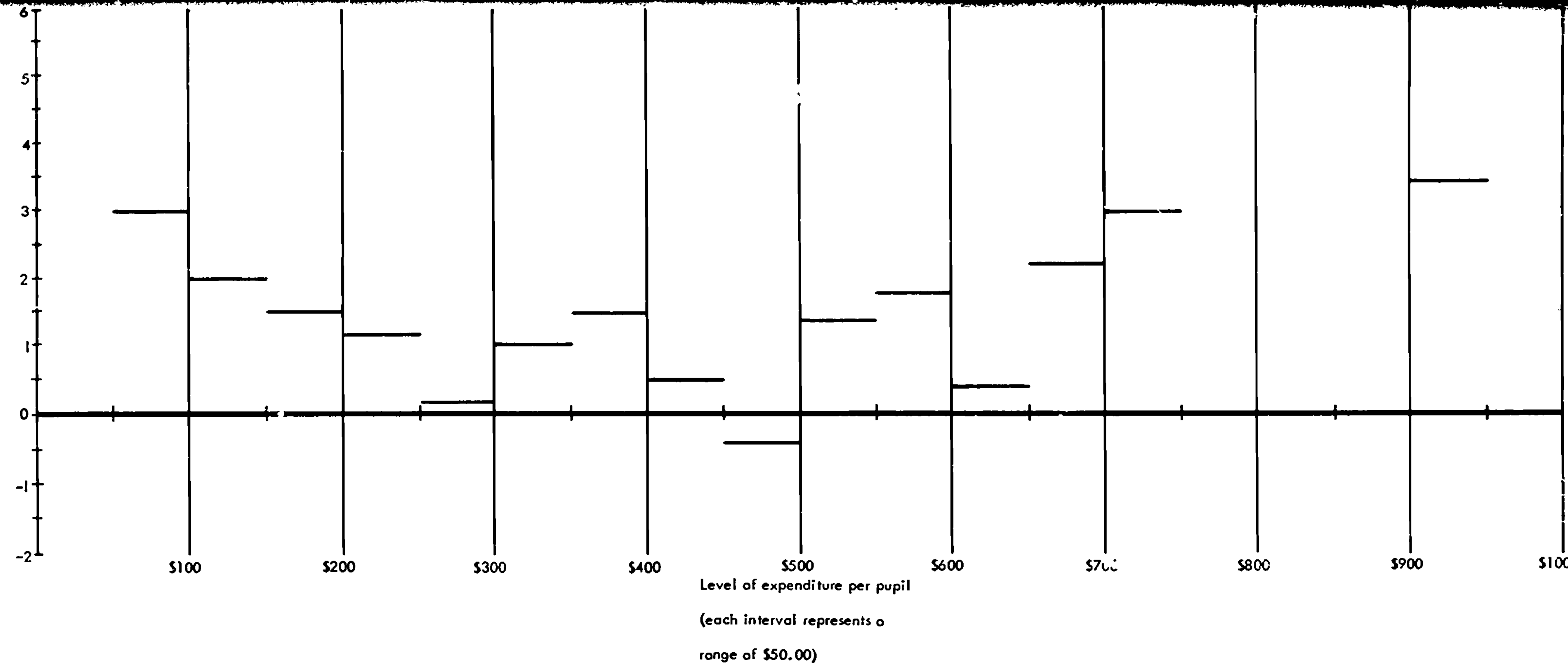
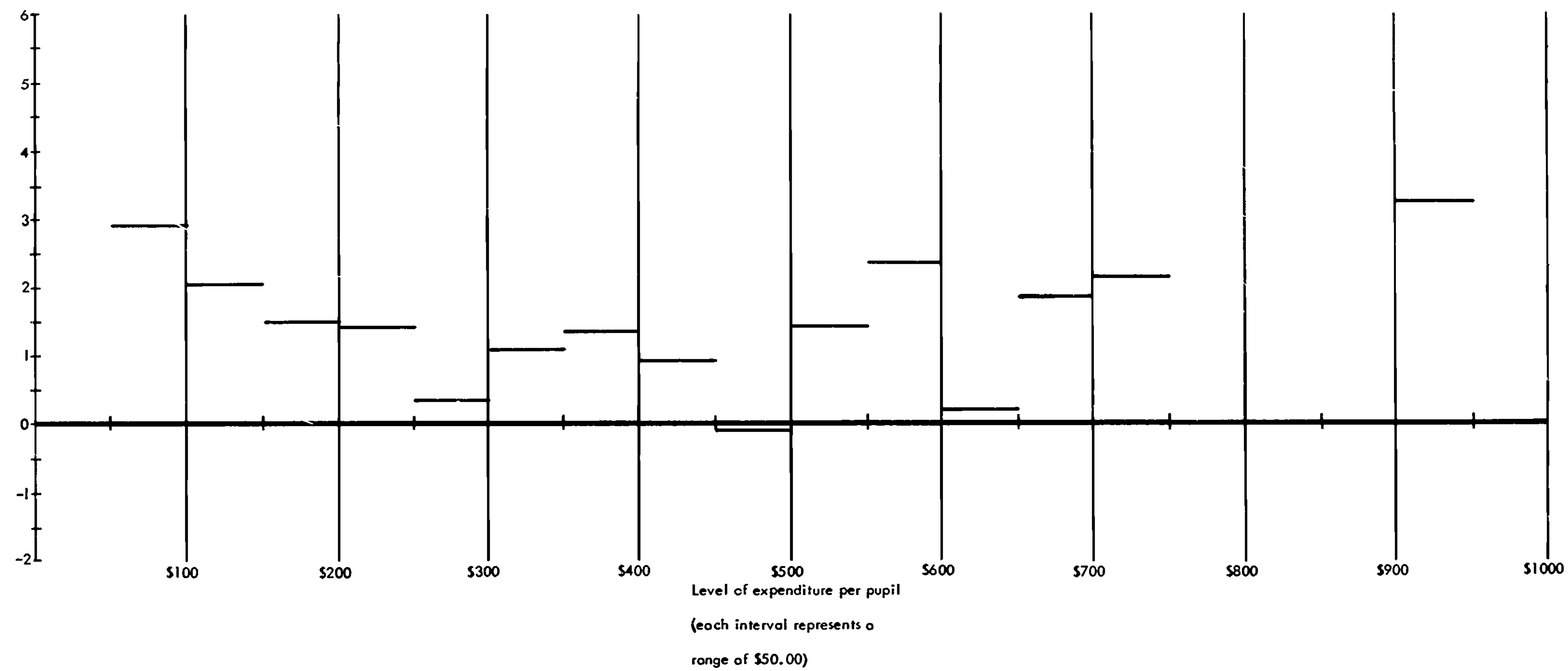


Chart 12

NINTH GRADE

MATHEMATICS FACTOR SCORE

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 1-24 appear on page 60

Chart 13

TWELFTH GRADE

ENGLISH

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

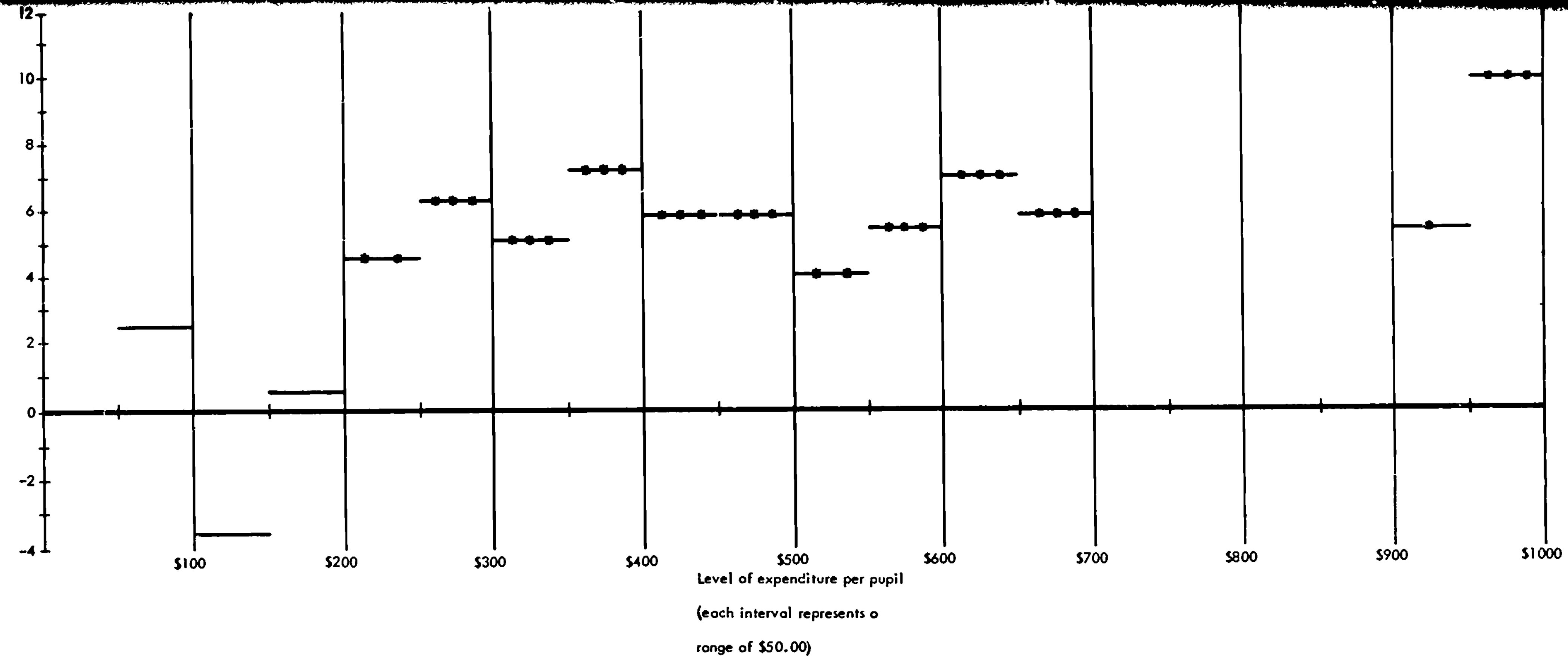
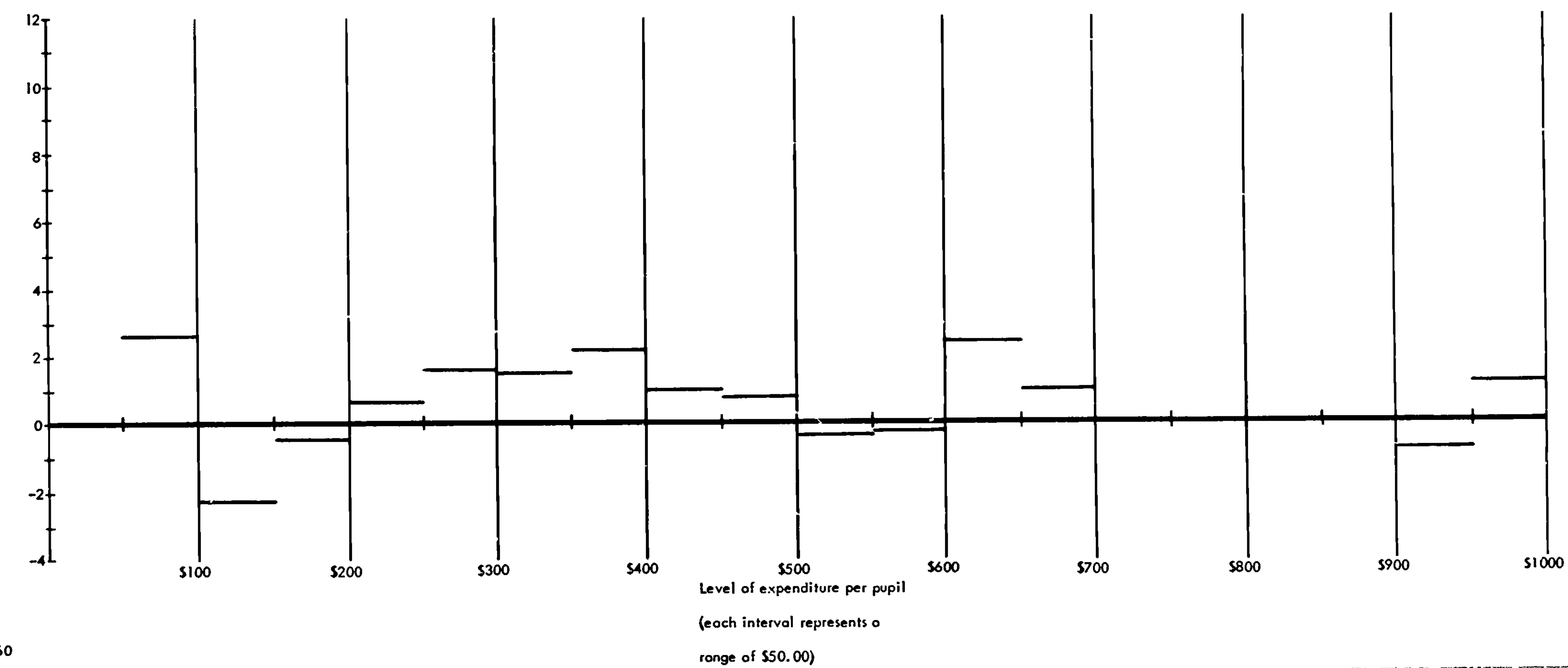


Chart 14

TWELFTH GRADE

ENGLISH

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 1-24 appear on page 60

15

TWELFTH GRADE

MATHEMATICS

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

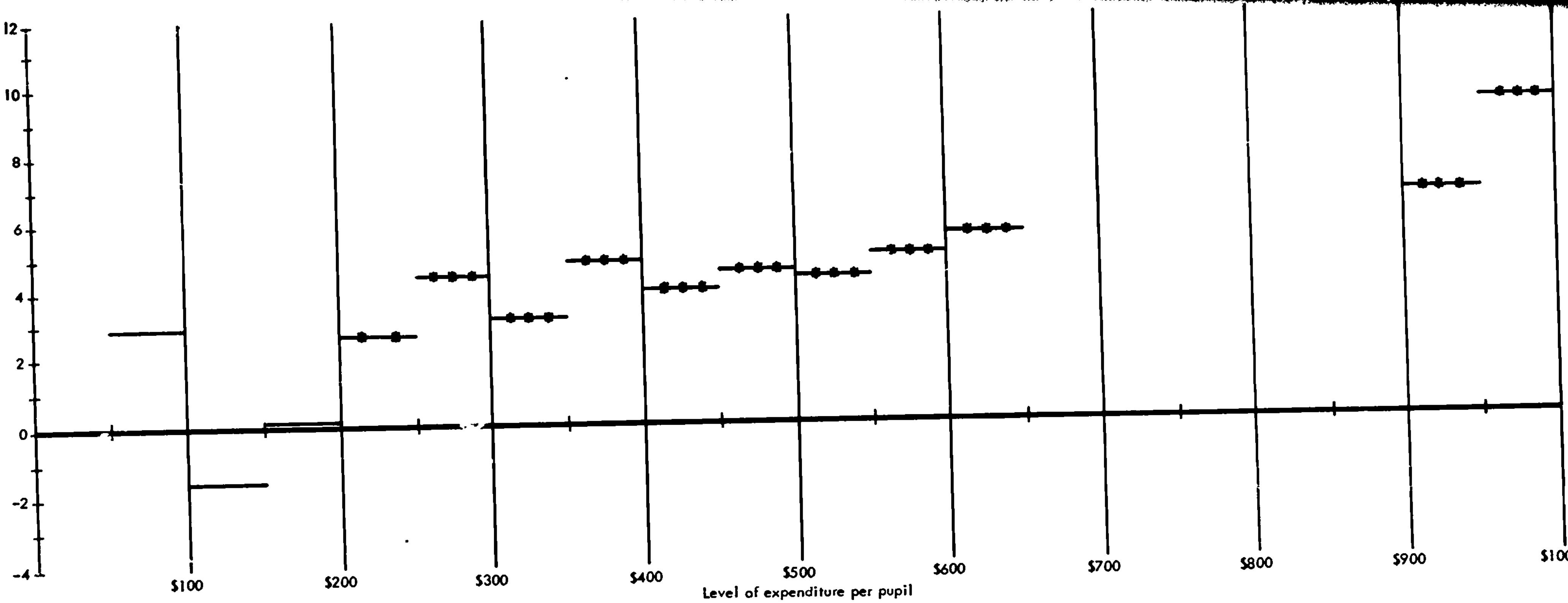
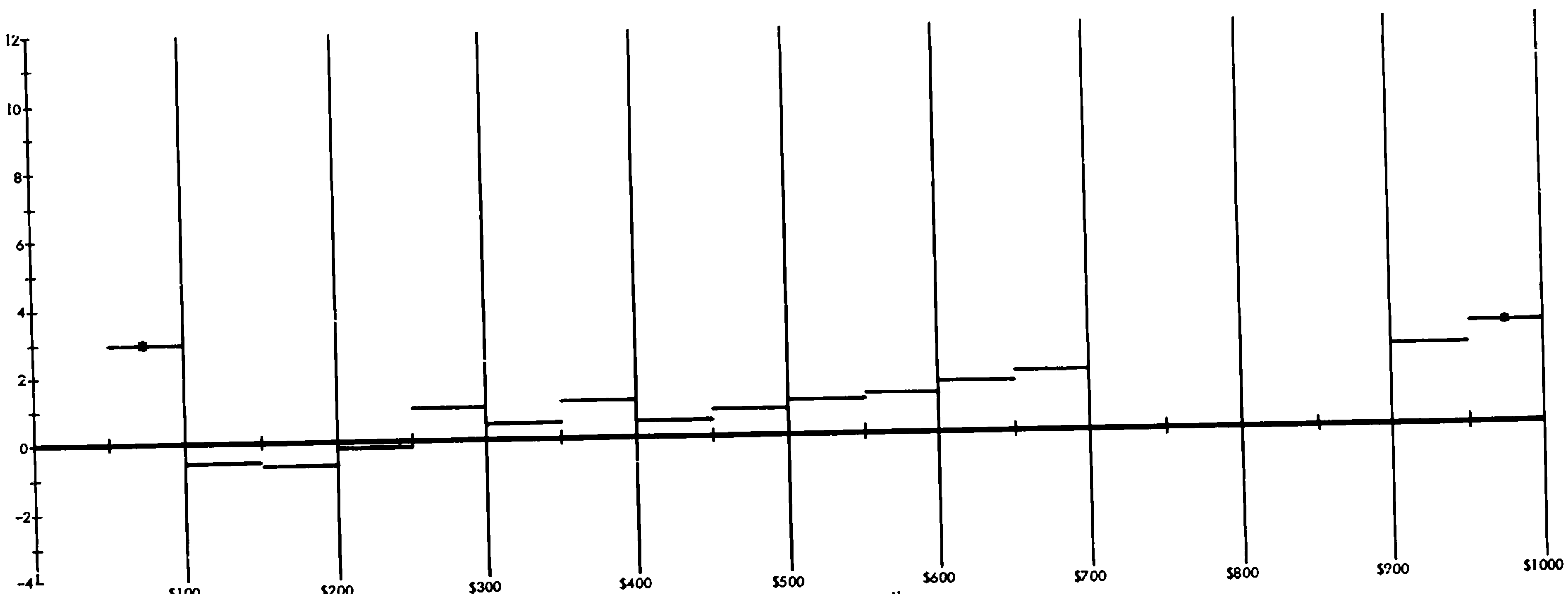


Chart 16

TWELFTH GRADE

MATHEMATICS

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 1-24 appear on page 60

Chart 17

TWELFTH GRADE

GENERAL SCHOOL APTITUDE

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

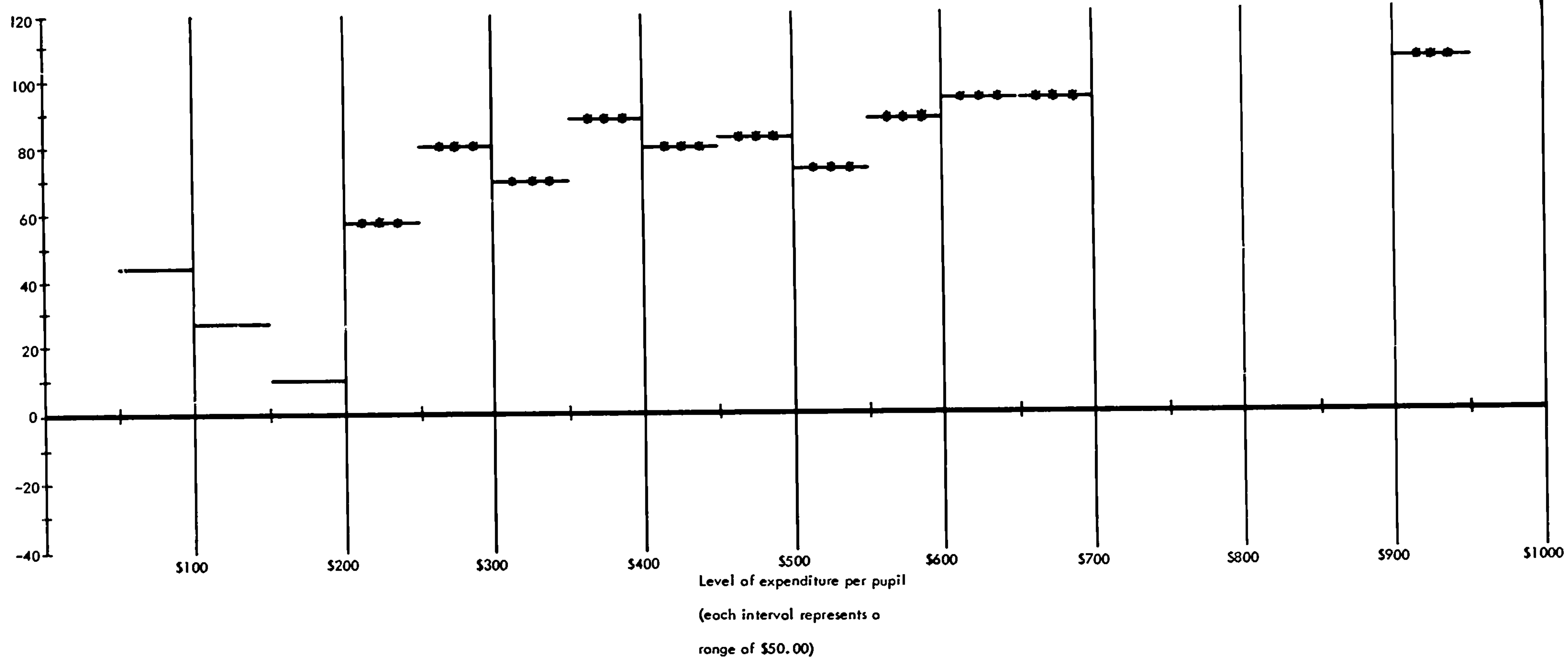
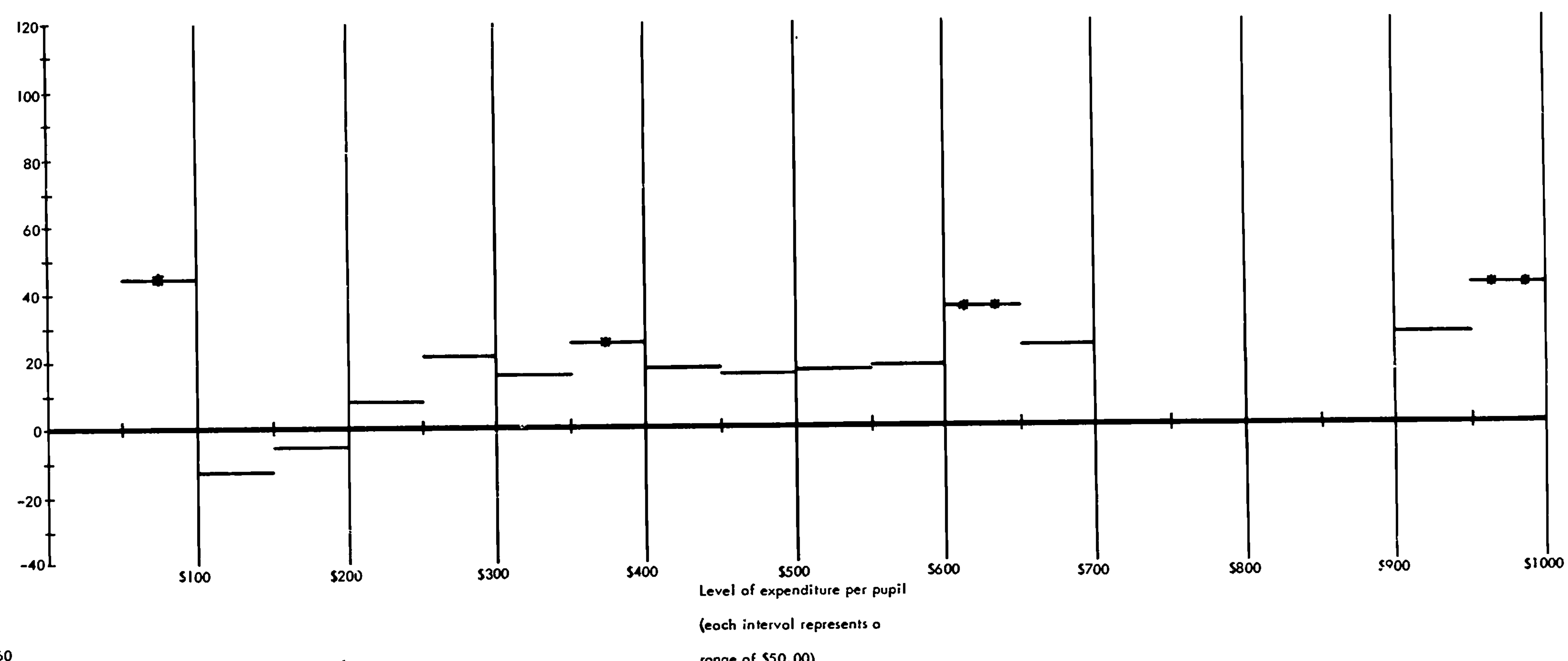


Chart 18

TWELFTH GRADE

GENERAL SCHOOL APTITUDE

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 1-24 appear on page 60

Chart 19

TWELFTH GRADE

GENERAL TECHNICAL APTITUDE

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

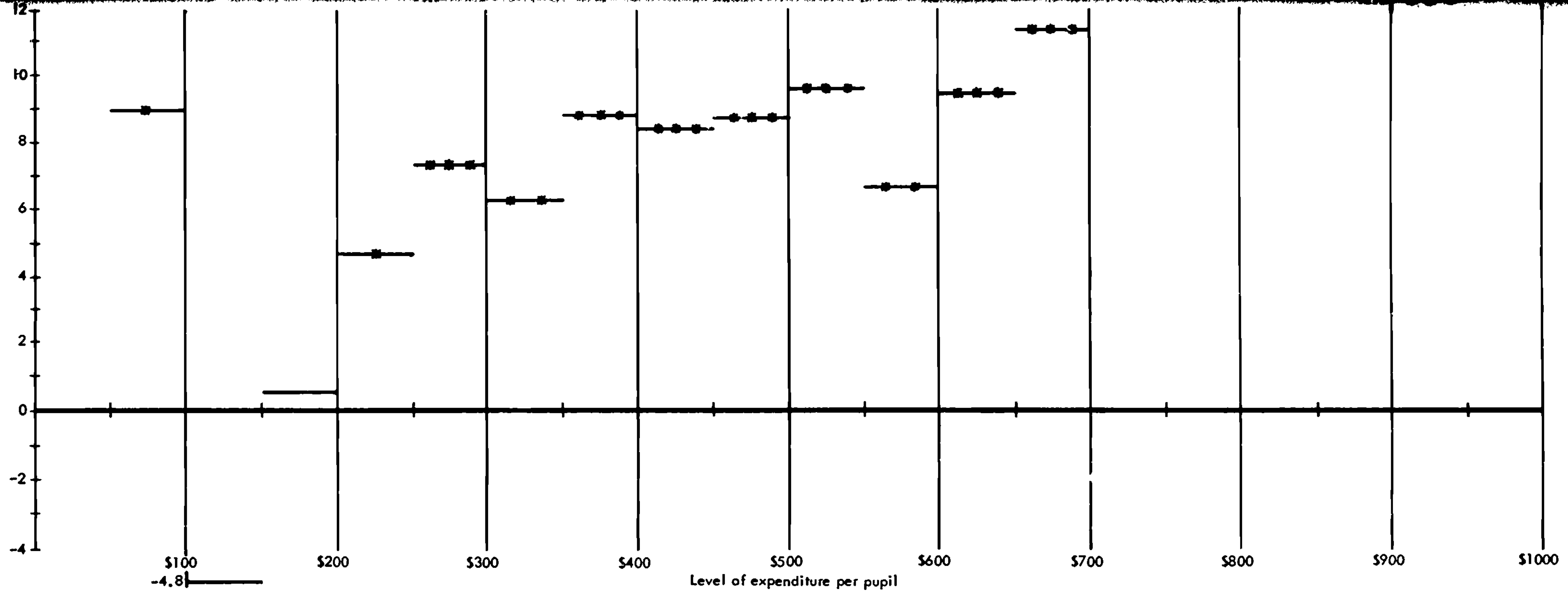
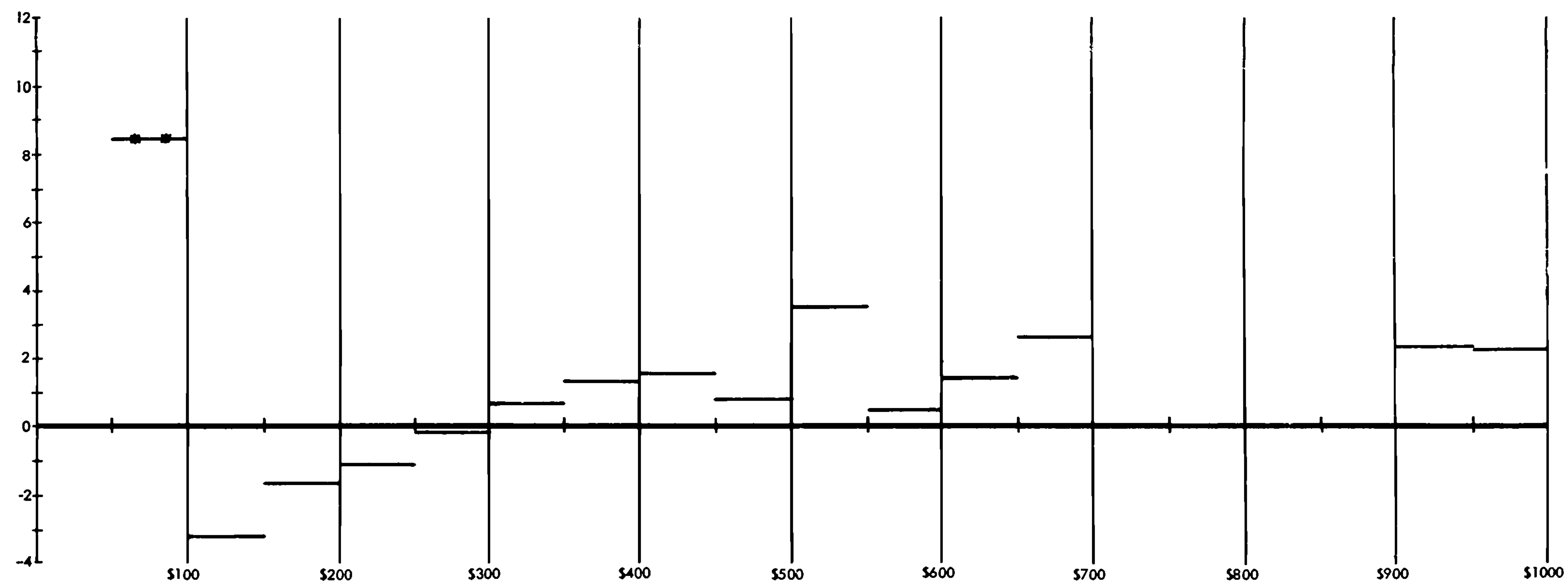


Chart 20

TWELFTH GRADE

GENERAL TECHNICAL APTITUDE

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 1-24 appear on page 60

Chart 21

TWELFTH GRADE

ENGLISH FACTOR SCORE

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

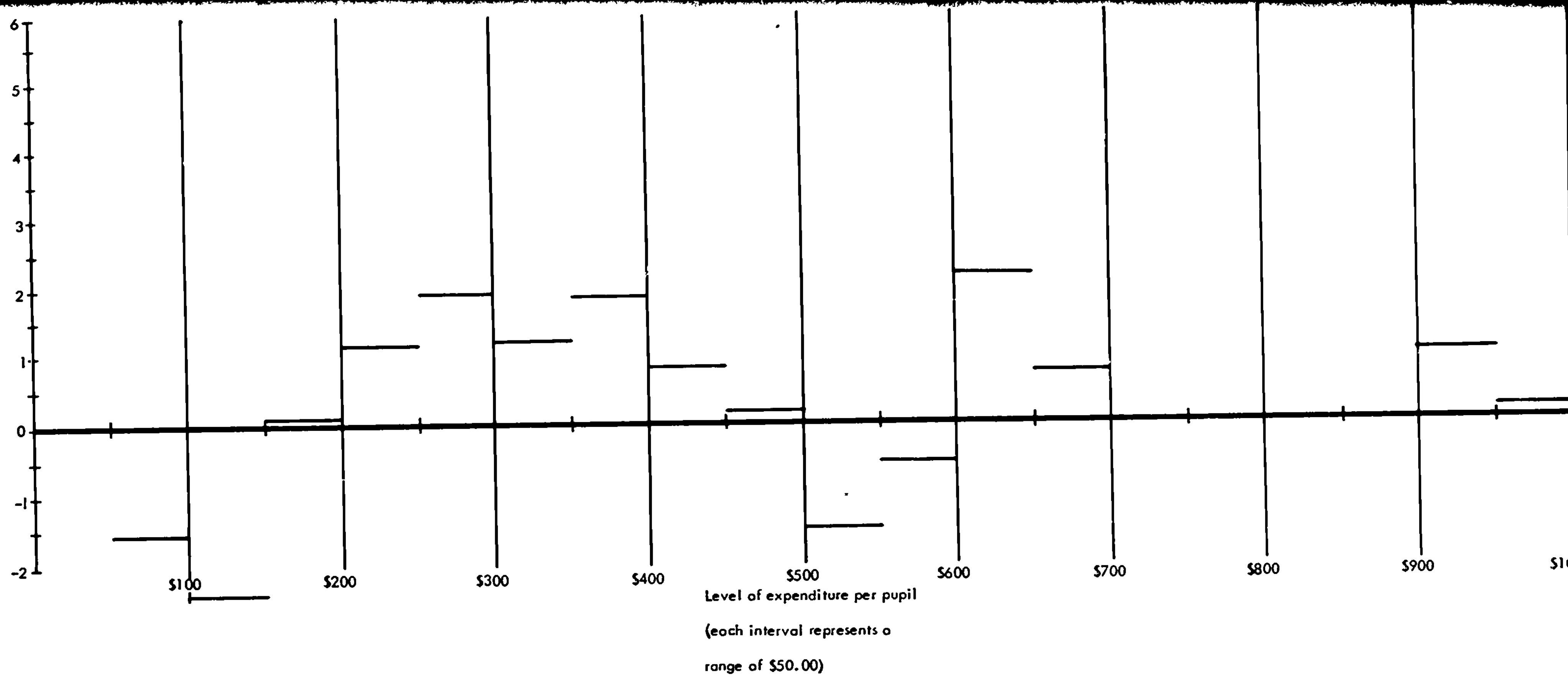
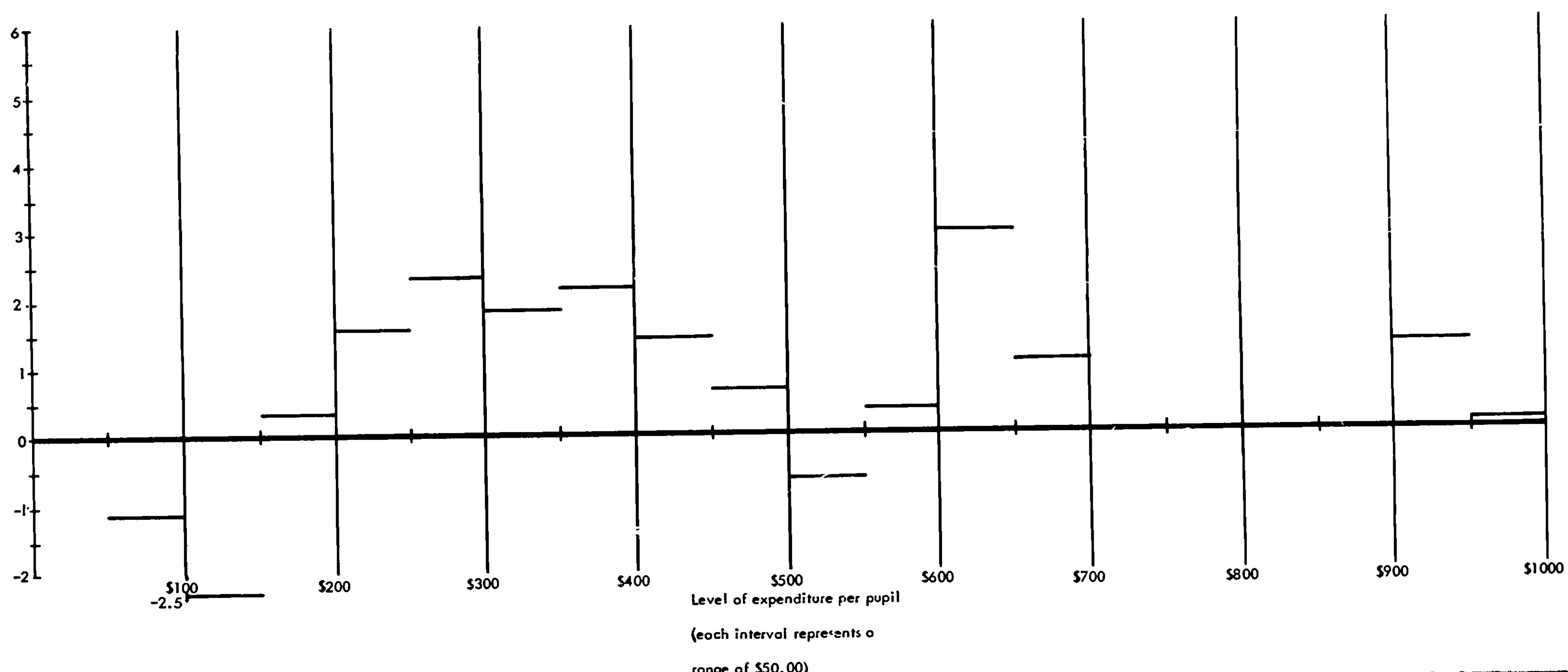


Chart 22

TWELFTH GRADE

ENGLISH FACTOR SCORE

(Net of the effects of intelligence, socio-economic background, and high school size)

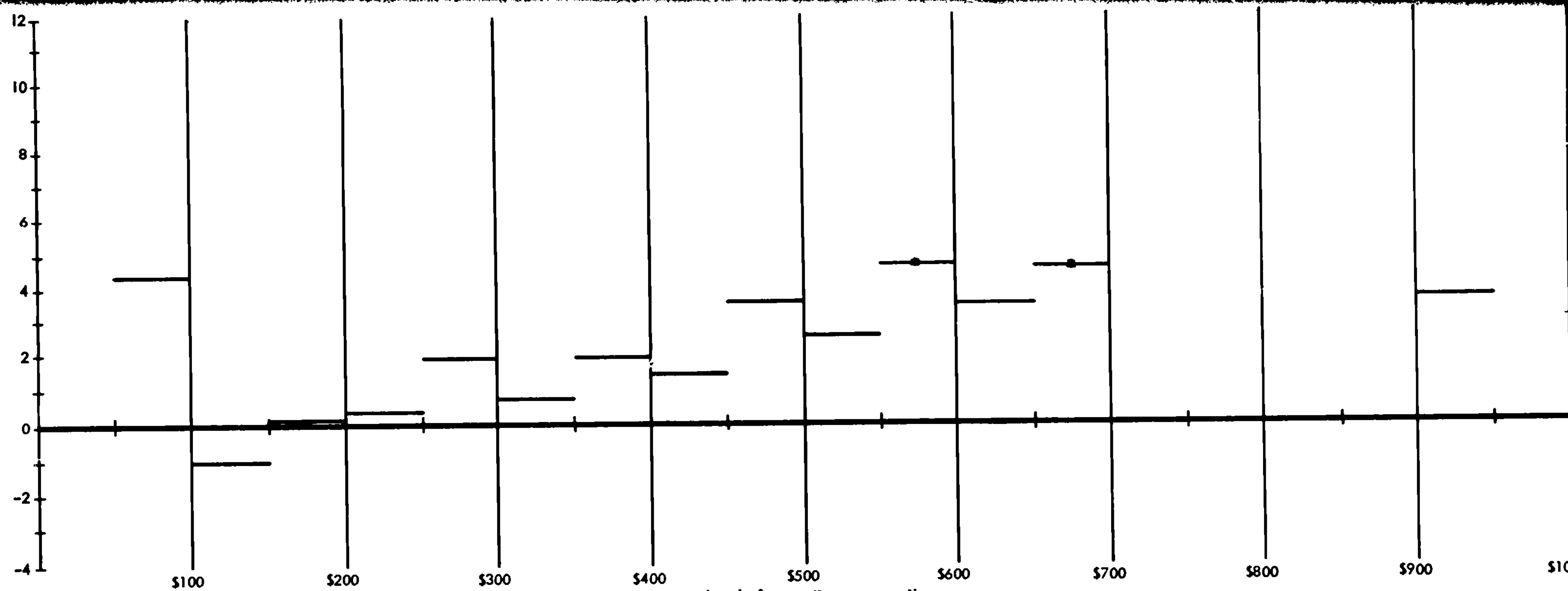


Notes to Charts 1-24 appear on page 60

TWELFTH GRADE

MATHEMATICS FACTOR SCORE

(No allowance made for the effects of intelligence, socio-economic background, and high school size)



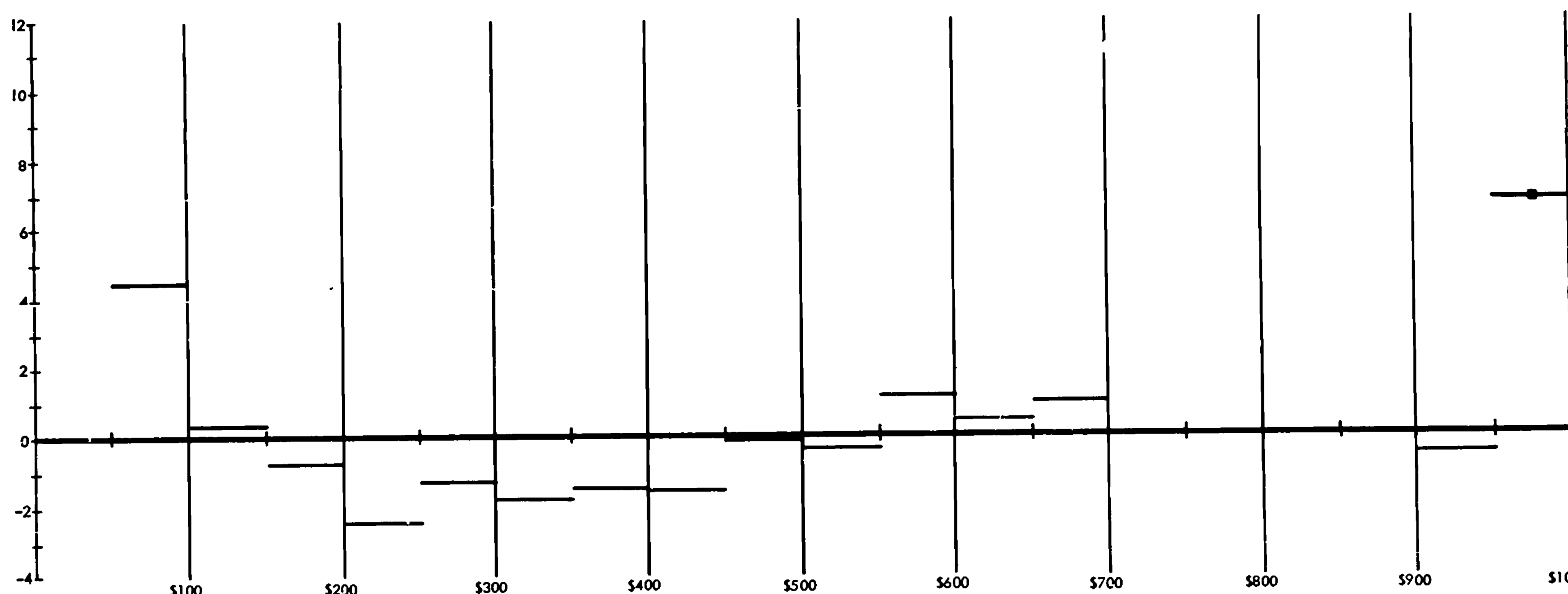
Level of expenditure per pupil (each interval represents a range of $50.00)

Chart 24

TWELFTH GRADE

MATHEMATICS FACTOR SCORE

(Net of the ef[illegible] of intelligence, socio-economic background, and high school size)



Level of expenditure per pupil (each interval represents a range of $50.00)

Notes to Charts 1-24 appear on page 60

Notes, Charts 1-24

Description: Dummy Variables

The details of the construction of the dummy variables are given in the text, page 44. In general, the value of the line drawn in the chart for each dummy variable interval is the predicted value, vis-a-vis some starting point, of the performance of pupils whose high schools fall in the particular expenditure interval represented by the dummy variable. The starting point in these charts is the value of the base line which can also be taken as the value of the first dummy variable.

Statistical Significance

Asterisks have been added to the lines for each dummy variable value to denote statistical significance. The presence of one to three asterisks denotes significance at the 90 percent, 95 percent, and 99 percents levels, respectively. However, the reader is advised that the overall expenditure-performance relationship can be significant even if the individual dummy variable values comprising it are not. As explained in the text, the primary purpose of using dummy variables is to trace the shape of the functional relationships.

Beta Coefficients

The values given in the charts are b-weights and not beta coefficients. To give the reader an idea of the relative magnitude of the effects, the following standard deviations are provided:

	Grade 9	Grade 12
English	13.5	12.0
Mathematics	6.5	8.2
General School Aptitude	111.4	117.9
General Technical Aptitude	15.4	18.5
English Factor Score	10.3	9.8
Mathematics Factor Score	9.5	10.4

Number of Observations

The number of pupils in Grade 9 was 5,122 and in Grade 12, 5,692. Dummy variables for which there were fewer than 20 pupils have been omitted from the charts.

functions, since it is probably true, as discussed above, that the two situations bracket the true value. The "gross" and "net" relationships for each measure are superimposed on the same page for convenience in reading and interpretation.

The findings for grade 9 are presented in Charts 1-12. They can be summarized into the following points.

1. With the exception of the Mathematics Factor score, the expenditure performance relationship, whether gross or net of the intelligence, size, and socio-economic variables, seems fairly linear. The Mathematics Factor score relationship is curiously U-shaped, however.

2. When the four non-factor measures are considered (English, Mathematics, Technical Aptitude, and School Aptitude), it is curious that one category of expenditure, that for the range from $750 to $799 per pupil, stands out as producing much better performance than any of the rest. This is more curious because this relationship disappears when the intelligence, size, and socio-economic variables are entered into the regression equation. If it were not for the $750 to $799 category, it would be easy to conclude for the four scores that performance of pupils in high schools is fairly constant between the $350 and $1000 levels of expenditure, i.e., that pupil performance at the $400 level is almost as good as pupil performance at the $900 level. As it is, it is difficult to decide what the shape of the relationship for these four scores should be, especially if we consider the low performance of pupils in the $950 to $999 category. Possibly the best compromise would be a straight line.

3. When the intelligence, size, and socio-economic variables are entered into the regression equation for the four non-factor scores, the importance of additional expenditure appears to be much less. However, the net expenditure-performance relationship, unlike the corresponding gross relationships, could easily be unambiguously linear. A possible interpretation for the shape of the relationship for the School Aptitude and English scores might be one which increases logarithmically, with performance increasing relatively less as expenditure increases beyond the $400-per-pupil level.

4. The English Language Factor score seems related, both gross and net, to expenditure in linear fashion, although the relationship is not as well defined for the English Factor score as it is for the non-factor score. The introduction of the intelligence, size, and socio-economic variables does not appear to affect the English Language Factor score relationship to expenditure very much.

5. A most curious 9th grade result is the apparent U-shaped relationship between expenditure and the Mathematics Factor score. The relationship is not overly well defined, however, as can be seen by the lack of significance of most of the individual dummy variables. Why it would be that schools which spend as little as $100 per pupil

would have pupils which score high on the Mathematics Factor score is something of a mystery to the author. The result could be a statistical quirk, especially since none of the individual dummy variables is significant at 10 percent level. Even so, the relationship is interesting and must be taken to be descriptively correct despite the lack of statistical significance. It would appear that the functional relationship for the expenditure-performance relationship for the Mathematics Factor score in the 9th grade should have been quadratic.

6. Turning to the magnitude of the relationships, the lines as drawn in Charts 1-12 would suggest that the expenditure of an additional $100 per pupil is associated with the increased performance of about one tenth of a standard deviation of the dependent variable. If the relationship is taken net of the intelligence, size, and socio-economic variables, then the relationship would appear to be about one third this great.

7. The relationships shown in Charts 1-12 confirm the findings shown above for grade 9 (see page 36) that the introduction of the intelligence, size, and socio-economic variables does not lessen the significance of the expenditure-performance relationship to a great extent, although it does reduce its magnitude.

The findings which correspond to those just presented for grade 9 are presented in Charts 13-24 for grade 12. There are some interesting differences between the 9th grade and 12th grade relationships. The following points briefly summarize the information shown in Charts 13-24.

1. As in the 9th grade, the four non-factor score relationships gross of the intelligence, size, and socio-economic variables, are highly related to expenditure and well defined.

2. With the possible exception of the English score the relationships are also quite linear. The English relationship could be logarithmic with performance increasing at a decreasing rate beyond the $300 to $400 level of expenditure.

3. An important difference for the four traditional scores between 9th grade and 12th grade is that at the 12th grade level the introduction of intelligence, size, and socio-economic background reduces the importance of the expenditure variable a good deal more than it does in the 9th grade. This is especially true for English and Technical Aptitude.

4. The factor score results are topsy-turvy from what was found to be true in the 9th grade. That is to say, the relationship of expenditure to the Mathematics Factor score is well defined while that for the English Factor score is poorly defined, or perhaps better expressed, non-existent.

5. The relationship of expenditure to both factor scores at the 12th grade level seems to be reduced to meaninglessness by the introduction of the intelligence, size, and socio-economic variables. Judging

from the discussion on pages 36 and 43 above, the effect of the intelligence variable is probably overstated, however. This is especially true with the factor scores which are constructed from residual variation left <u>after</u> extraction of the Verbal Knowledges Factor.

General Summary: Expenditure Dummy Variables, All Pupils

To summarize the general relationships for grades 9 and 12 then, it would appear that the following are true with respect to the dummy variable findings.

1. The relationships seem fairly linear.

2. The apparent relationship between the four non-factor scores and expenditure is quite strong when the intelligence, size, and socio-economic variables are not entered into the equation. They are still fairly strong and well defined in the 9th grade even with the introduction of these variables but much less so at the 12th grade level.

3. The behavior of the factor scores is curious with a well-defined relationship for Mathematics (gross) in the 12th grade and for English in the 9th grade. The reason that the Mathematics score might be more important in the 12th grade and English score more important in the 9th grade has been discussed above. Briefly, Mathematics is a subject which is more associated with what is taught in the high school. The English Factor used is one in which the academic aspects may have been more or less eliminated by the Verbal Knowledges Factor score, leaving a residual of more mechanical English skills. Such skills are taught in grade levels immediately prior to the 9th grade such that they would be strong at that grade level, but they are not taught as much in high school where the emphasis is more upon literature.

4. Finally, the relationship of expenditure to performance, net of the three other variables in the model, is quite weak. This is especially true in grade 12. One explanation for this phenomenon, at least in part, would involve the effects of high school drop outs. Thus, at the 9th grade level there are more poorly performing students percentage-wise in the low spending, low socio-economic schools and so low performance is hitched to low expenditure. By the time the pupils have reached the 12th grade level, however, the poorer students in the low socio-economic high schools have dropped out and such high schools appear therefore to perform better than they actually do. This hypothesis will be checked in part in the next section when we will examine pupil populations which are stratified according to father's education. A good argument against the hypothesis is the fact that the effect of such socio-economic differences between grades 9 and 12 should be captured through the use of the socio-economic variable itself.

Results When Pupils are Stratified According to Father's Education

It is important to inquire into what can be learned with the use of dummy variables concerning functional relationships for pupils from more homogeneous socio-economic backgrounds. In this section findings are given for pupils stratified according to three levels of father's education.[42] Because of limitations of space, results are given for only the Mathematics score in chart form (Charts 25-30). In addition, the findings for all six of the scores are summarized verbally in some detail in Tables 10-15. In those tables are given the authors best estimate of how well defined the relationships are, their statistical significance, a graphic representation of the function, a rough estimate of the normalized slope coefficients assuming a linear relationship, and finally, the actual computed beta coefficients along with the applicable values of the t-statistic.

Perhaps the most important finding in Tables 10-15 is that there is little noticeable difference in the relationships of expenditure to pupil performance according to differences in educational backgrounds. In particular, many of the relationships for pupils from the lowest educational backgrounds are as strong or stronger than for the two higher groups. This is an important finding in light of some of the author's past work and constitutes one badly needed vote for the proposition that American schools are not doing a particularly terrible job with pupils from the lowest socio-economic backgrounds. The only exception to this generalization, and it would be an important one, might be with respect to performance on the Mathematics Factor score in grade 12. This is not conclusive, however, since the values of the t-statistic for the coefficients of net regression computed for the continuous variable are themselves fairly high.

The relationships traced by the dummy variables would seem to suggest either simple linearity or else linearity in logarithms.[43] There is only one notable aberration from this, and that is the expenditure relationship for pupils from low education homes in grade 9 for the Mathematics Factor score which is curiously U-shaped. The majority of the expenditure performance relationships are positive and most of the positive relationships hold up even after pupil intelligence, pupil socio-economic background, and school size, have been entered into the regression equation. Most of the computed t-statistics are quite significant statistically and it is interesting to notice that even when the individual dummy variables are not statistically significant, the computed relationship for the continuous variable often is. This observation is relevant to the observation

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[42]The three levels are: graduation from grade school or less; some high school or graduation from high school; and some college or more.

[43]That is to say, the function is well described by an equation of the form

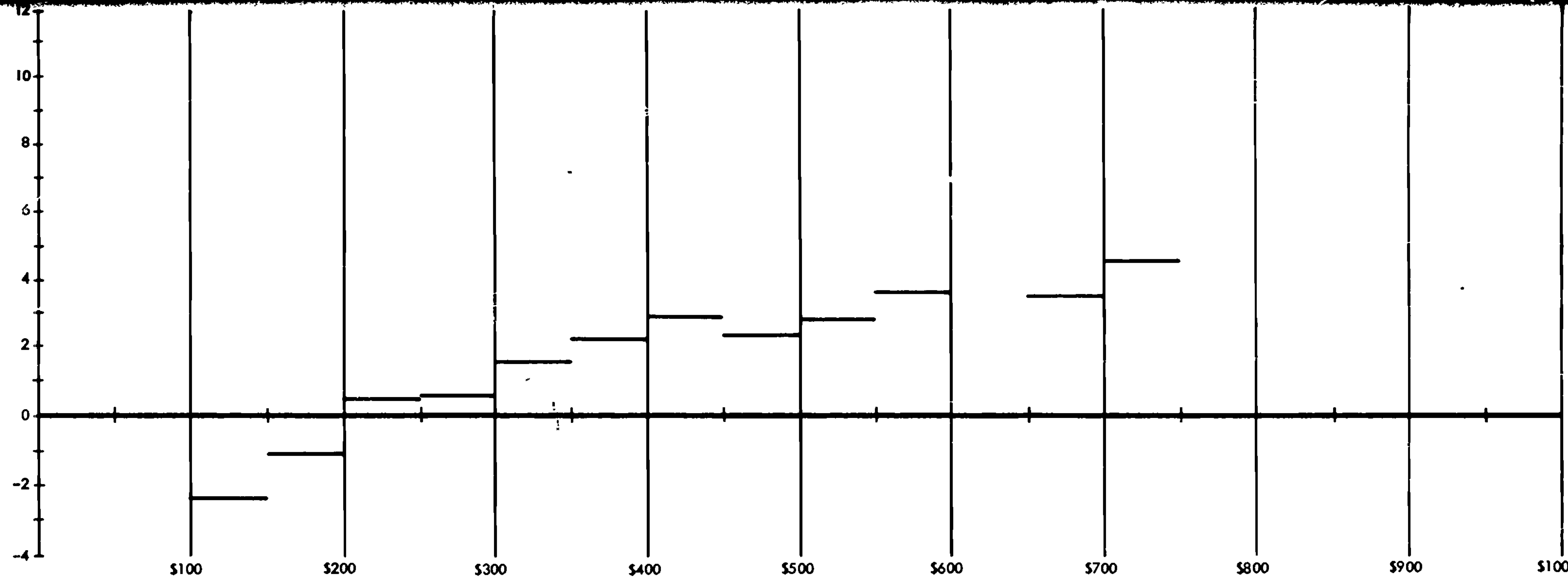
$$Y = a + b \text{ (logarithm of expenditure)}$$

Chart 25

NINTH GRADE

MATHEMATICS
HIGH FATHER EDUCATION

(No allowance made for the effects of intelligence, socio-economic background, and high school size)



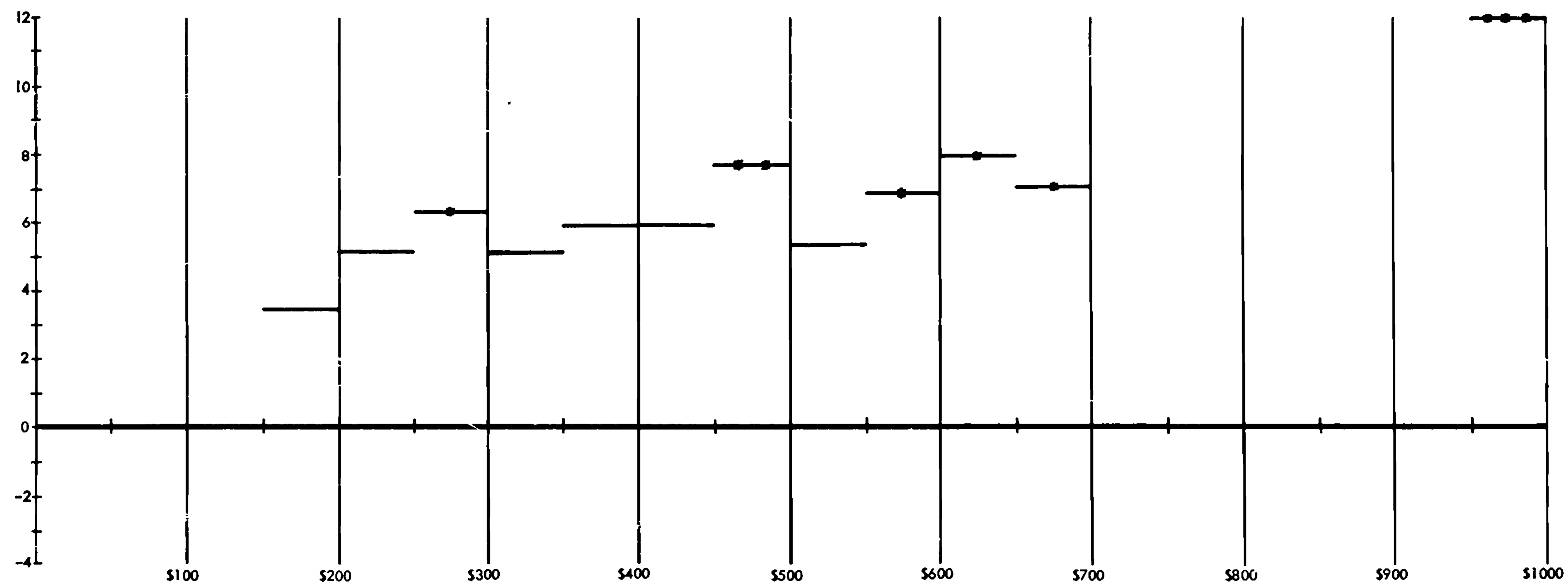
Level of expenditure per pupil (each interval represents a range of $50.00)

Chart 26

TWELFTH GRADE

MATHEMATICS
HIGH FATHER EDUCATION

(No allowance made for the effects of intelligence, socio-economic background, and high school size)



Level of expenditure per pupil (each interval represents a range of $50.00)

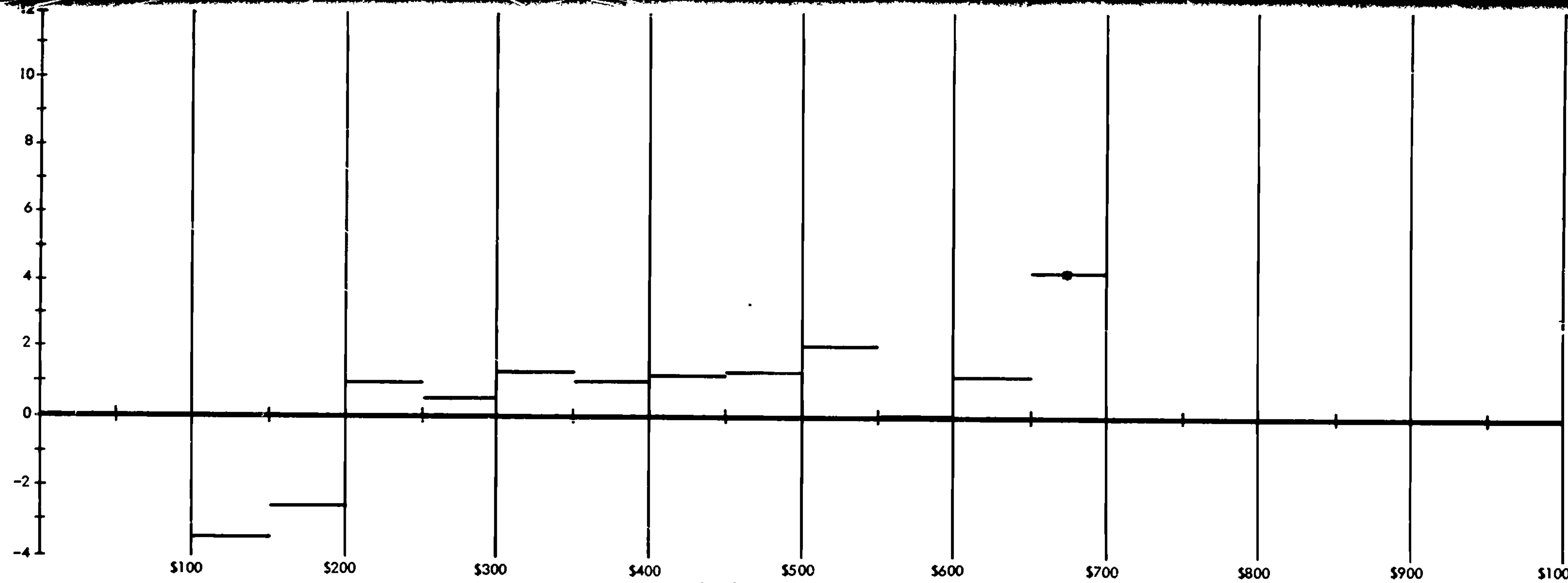
Notes to Charts 25-30 appear on page 68

Chart 27

NINTH GRADE

MATHEMATICS
MEDIUM FATHER EDUCATION

(No allowance made for the effects of intelligence, socio-economic background, and high school size)



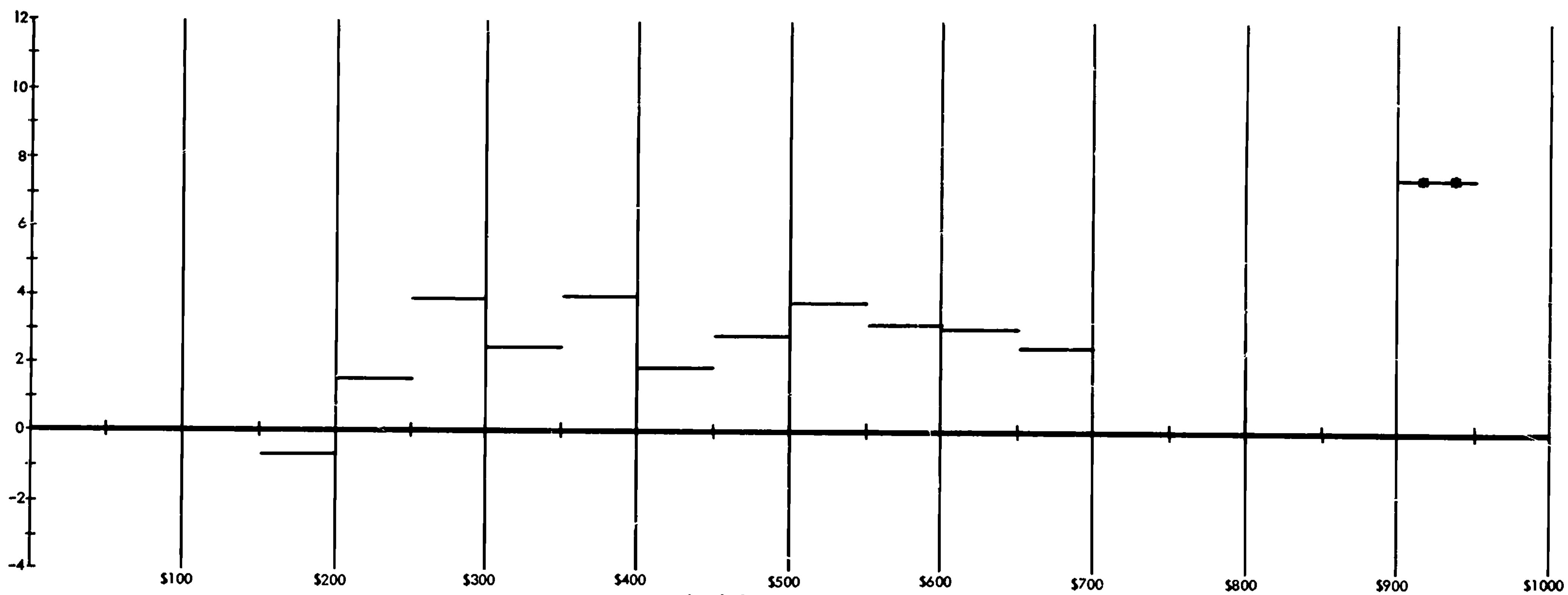
Level of expenditure per pupil (each interval represents a range of $50.00)

Chart 28

TWELFTH GRADE

MATHEMATICS
MEDIUM FATHER EDUCATION

(No allowance made for the effects of intelligence, socio-economic background, and high school size)



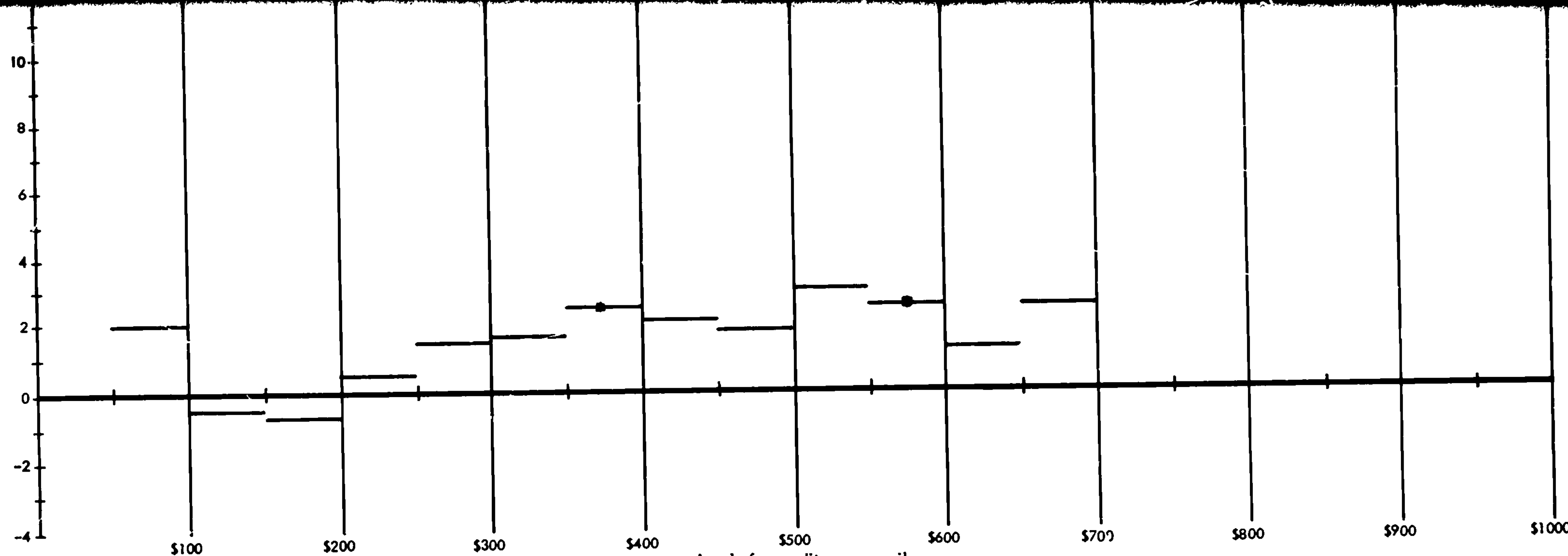
Level of expenditure per pupil (each interval represents a range of $50.00)

Notes to Charts 25-30 appear on page 68

NINTH GRADE

MATHEMATICS
LOW FATHER EDUCATION

(No allowance made for the effects of intelligence, socio-economic background, and high school size)



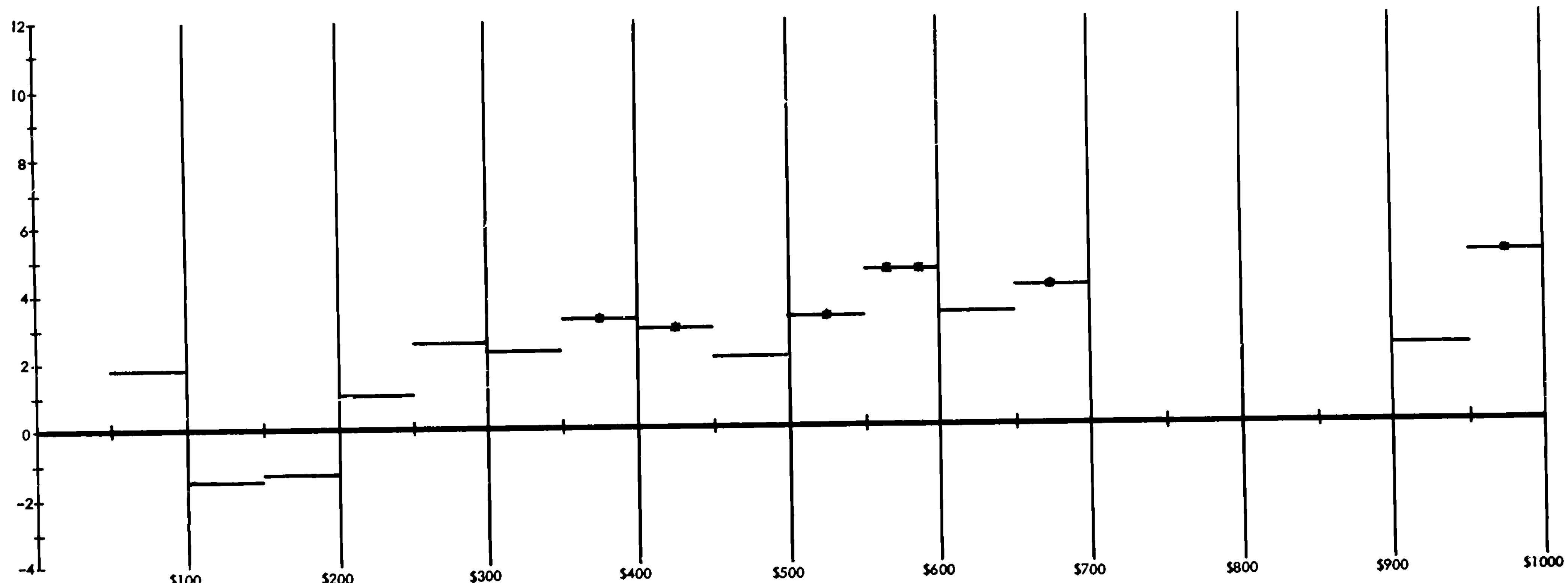
Level of expenditure per pupil
(each interval represents a range of $50.00)

Chart 30

TWELFTH GRADE

MATHEMATICS
LOW FATHER EDUCATION

(No allowance made for the effects of intelligence, socio-economic background, and high school size)



Level of expenditure per pupil
(each interval represents a range of $50.00)

Notes to Charts 25-30 appear on page 68

Notes, Charts 25-30

Description: Dummy Variables

See notes to Charts 1-24, page 60.

Statistical Significance:

—*— = Significant at 90%
—**— = Significant at 95%
—***— = Significant at 99%

See also notes to charts 1-24, page 60.

Beta Coefficients

The values given in the charts are b-weights and not beta coefficients. To give the reader an idea of the relative magnitudes of the effects, the following standard deviations are provided:

Mathematics Score	Grade 9	Grade 12
High Father Education	7.4	8.4
Intermediate Father Education	6.4	8.3
Low Father Education	5.7	7.7

Number of Observations

The number of pupils to which the pupil performance in each chart was fitted were as follows:

	Grade 9	Grade 12
High Education	821	1041
Intermediate Education	1309	1515
Low Education	1867	2462

Dummy variables for which there are fewer than 10 pupils were omitted from the charts.

TABLE 10

SUMMARY OF DUMMY VARIABLE FINDINGS, EXPENDITURE,
HIGH, MEDIUM, LOW FATHER EDUCATION, GRADES 9 AND 12

English

		Relationship					
		How Well Defined	Statistical Significance	Function Shape	Estimated Beta Coefficient	Computed Beta Coefficient	t-value of Computed Beta Coefficient
GRADE 9	High Education, Gross	Undefined	Poor		--	.138	3.97
	High Education, Net	Undefined	Poor		--	.060	1.92
	Medium Education, Gross	Good	Good		.125	.097	3.52
	Medium Education, Net	Excellent	Excellent		.134	.066	2.57
	Low Education, Gross	Fair	Fair		.062	.079	3.41
	Low Education, Net	Undefined	Poor		--	.031	1.34
GRADE 12	High Education, Gross	Good	Poor		.067	.045	1.45
	High Education, Net	Undefined	Poor		--	.013	0.45
	Medium Education, Gross	Undefined	Poor		--	.004	0.16
	Medium Education, Net	Undefined	Poor		--	-.007	0.31
	Low Education, Gross	Poor	Fair		.090	.053	2.60
	Low Education, Net	Undefined	Poor		--	-.023	1.20

NOTES: Notes to Tables 10-15 appear on page 75.

TABLE 11

SUMMARY OF DUMMY VARIABLE FINDINGS, EXPENDITURE,
HIGH, MEDIUM, LOW FATHER EDUCATION, GRADES 9 AND 12

Mathematics

		Relationship					
		How Well Defined	Statistical Significance	Function Shape	Estimated Beta Coefficient	Computed Beta Coefficient	t-value of Computed Beta Coefficient
GRADE 9	High Education, Gross	Good	Poor		.146	.179	5.19
	High Education, Net	Good	Poor		.108	.091	3.09
	Medium Education, Gross	Good	Poor		.159	.100	3.62
	Medium Education, Net	Fair	Poor		.122	.063	2.59
	Low Education, Gross	Fair	Good		.090	.122	5.31
	Low Education, Net	Fair	Fair		.098	.067	3.04
GRADE 12	High Education, Gross	Good	Good		.150	.121	3.93
	High Education, Net	Fair	Fair		.125	.088	3.19
	Medium Education, Gross	Poor	Poor		.148	.066	2.55
	Medium Education, Net	Fair	Fair		.105	.058	2.49
	Low Education, Gross	Good	Good		.100	.124	6.16
	Low Education, Net	Undefined	Poor		---	.037	1.96

NOTES: Notes to Tables 10-15 appear on page 75.

TABLE 12

SUMMARY OF DUMMY VARIABLE FINDINGS, EXPENDITURE,
HIGH, MEDIUM, LOW FATHER EDUCATION, GRADES 9 AND 12

General School Aptitude

		Relationship					
		How Well Defined	Statistical Significance	Function Shape	Estimated Beta Coefficient	Computed Beta Coefficient	t-value of Computed Beta Coefficient
GRADE 9	High Education, Gross	Good	Poor		.188	.187	5.44
	High Education, Net	Poor	Poor		.032	.084	3.10
	Medium Education, Gross	Good	Poor		.140	.110	4.01
	Medium Education, Net	Fair-Good	Poor		.075	.066	2.92
	Low Education, Gross	Good	Fair		.122	.140	6.11
	Low Education, Net	Poor	Poor		.050	.068	3.30
GRADE 12	High Education, Gross	Good-Excellent	Good		.115	.108	3.51
	High Education, Net	Good	Poor		.064	.068	2.74
	Medium Education, Gross	Poor	Poor		.075	.058	2.23
	Medium Education, Net	Fair	Poor		.064	.047	2.24
	Low Education, Gross	Fair	Good		.076	.130	6.50
	Low Education, Net	Undefined	Poor		--	.023	1.37

NOTES: Notes to Tables 10-15 appear on page 75.

TABLE 13

SUMMARY OF DUMMY VARIABLE FINDINGS, EXPENDITURE,
HIGH, MEDIUM, LOW FATHER EDUCATION, GRADES 9 AND 12

General Technical Aptitude

		Relationship					
		How Well Defined	Statistical Significance	Function Shape	Estimated Beta Coefficient	Computed Beta Coefficient	t-value of Computed Beta Coefficient
GRADE 9	High Education, Gross	Good	Poor		.161	.158	4.58
	High Education, Net	Fair	Poor		.035	.060	2.23
	Medium Education, Gross	Poor	Poor		.096	.097	3.52
	Medium Education, Net	Good	Poor		.071	.061	2.80
	Low Education, Gross	Good	Excellent		.099	.121	5.28
	Low Education, Net	Good	Good		.052	.059	3.08
GRADE 12	High Education, Gross	Poor	Fair		.080	.025	0.81
	High Education, Net	Undefined	Poor		--	.005	0.19
	Medium Education, Gross	Undefined	Poor		--	.024	0.94
	Medium Education, Net	Undefined	Poor		--	.027	1.27
	Low Education, Gross	Poor	Poor		.090	.147	7.07
	Low Education, Net	Undefined	Poor		--	.065	3.89

NOTES: Notes to Tables 10-15 appear on page 75.

TABLE 14

SUMMARY OF DUMMY VARIABLE FINDINGS, EXPENDITURE,
HIGH, MEDIUM, LOW FATHER EDUCATION, GRADES 9 AND 12

English Factor

		Relationship					
		How Well Defined	Statistical Significance	Function Shape	Estimated Beta Coefficient	Computed Beta Coefficient	t-value of Computed Beta Coefficient
GRADE 9	High Education, Gross	Undefined	Poor		--	.024	0.69
	High Education, Net	Undefined	Poor		--	.021	0.59
	Medium Education, Gross	Good	Poor		.089	.033	1.21
	Medium Education, Net	Good	Poor		.069	.035	1.26
	Low Education, Gross	Undefined	Poor		--	.018	0.77
	Low Education, Net	Poor	Poor		.022	.029	1.22
GRADE 12	High Education, Gross	Undefined	Poor		--	.017	0.54
	High Education, Net	Undefined	Poor		--	.014	0.46
	Medium Education, Gross	Undefined	Poor		--	-.013	0.51
	Medium Education, Net	Undefined	Poor		--	-.019	0.76
	Low Education, Gross	Undefined	Poor		--	-.056	2.77
	Low Education, Net	Undefined	Poor		--	-.036	1.75

NOTES: Notes to Tables 10-15 appear on page 75.

TABLE 15

SUMMARY OF DUMMY VARIABLE FINDINGS, EXPENDITURE,
HIGH, MEDIUM, LOW FATHER EDUCATION, GRADES 9 AND 12

Mathematics Factor

		Relationship					
		How Well Defined	Statistical Significance	Function Shape	Estimated Beta Coefficient	Computed Beta Coefficient	t-value of Computed Beta Coefficient
GRADE 9	High Education, Gross	Fair	Poor		.066	.054	1.55
	High Education, Net	Undefined	Poor		--	.039	1.12
	Medium Education, Gross	Undefined	Poor		--	.010	0.36
	Medium Education, Net	Fair	Poor		.010	.014	0.50
	Low Education, Gross	Poor	Poor		--	-.024	1.14
	Low Education, Net	Fair	Poor		--	-.004	0.18
GRADE 12	High Education, Gross	Good	Fair-Good		.159	.114	3.68
	High Education, Net	Poor	Poor		.100	.094	3.15
	Medium Education, Gross	Fair	Poor		.038	.051	1.97
	Medium Education, Net	Fair	Poor		.235	.051	1.99
	Low Education, Gross	Undefined	Poor		--	.073	3.66
	Low Education, Net	Undefined	Poor		--	.038	1.85

NOTES: Notes to Tables 10-15 appear on page 75.

Notes, Tables 10-15

Meaning of Gross and Net

"Gross" means that the dependent variable is explained by expenditure dummy variables without allowance being made for the effects of school size, pupil intelligence (Verbal Knowledges Factor Score), and pupil socio-economic index. "Net" means that such allowance has been made.

Definition of Function

This is a subjective estimate by the author of how sharply the function represented under "Function Shape" is traced by the successive values for the dummy variable expenditure intervals. Thus, if a function is discernible but the plotted dummy variables often deviate from the function, it might be described as being "poor", etc.

Statistical Significance

This is an estimate of the overall statistical significance of the function made from the number of individual dummy variables which were statistically significant.

Estimated and Computed Beta Coefficients

The estimated beta coefficient is that for a hand-fitted line to the function on the assumption that the function is linear. The computed beta coefficient is that computed for the expenditure-performance relationship when the continuous expenditure variable is used.

Number of Observations

The number of pupils in each of the three education level categories are as follows.

	Grade 9	Grade 12
High	821	1037
Intermediate	1309	1504
Low	1867	2445

made above that the true contribution of the dummy variable approach is to show the shapes of the relationships and not their statistical significance, which is better computed with continuous variables once the probable shapes of the relationships are known.

The results shown in Tables 10-15 for the two factor scores are similar to what has been seen in Part II. Both are insignificant in grade 9 while only the Mathematics Factor score is significant in grade 12 and then only for pupils from the highest socio-economic background. All this is perhaps consistent with the hypothesis that mathematics is a more school-related skill and also that the English Factor score is itself a poor measure of quality. If the Mathematics Factor score is in fact a good measure of quality, as hypothesized above, then the findings for grade 12 are somewhat disturbing, since the relationships for pupils from the two lowest educational groupings demonstrate Mathematics Factor performance which is poorly related to school expenditure.

The highly significant value for the continuous relationship for the Technical Aptitude score in grade 12 for pupils from the lowest educational background is consistent with the supposition made above that high schools may substitute a technical education for an academic one for such pupils. If this is true, it suggests that merely to measure pupil performance on academic subject matter is not enough. Another hypothesis which was enunciated above with respect to pupils from disadvantaged backgrounds is that they are relatively more dependent upon their schools to give them language training. According to these findings this does not appear to be happening, however, as the English score for such pupils is poorly related to high school expenditure at both grade levels.

By comparing the estimated slopes as well as the computed slope coefficients before and after the introduction of the pupil intelligence, socio-economic, and school size variables, the reader can compare again the apparent affect of the presence of those variables in the multiple regression equation, this time for the situation where pupils are used as observations. The net expenditure relationships seem to hold up fairly well both with the dummy variable approach and continuous variable approach, although it is interesting that the slopes of the hand-fitted lines are much more overstated relative to their mathematically computed counterparts for the net relationships than for the gross relationships.

The Dummy Variable Findings Continued: High School Size Related to High School Performance

The dummy variable technique is also an excellent one with which to explore the relationship of high school size to high school performance. The procedure for constructing dummy variables for size was identical to that for expenditure, except that there are 45 beginning size intervals instead of 20.[44] As with expenditure, the central purpose of performing a dummy variable analysis for high school size is that it is a useful device for explaining the shape of the functional relationship. The introduction of the three control variables into the multiple-regression equation changes the size finding appreciably, and therefore charts are included for both the net and gross relationships for the six most important measures for grades 9 and 12 (Charts 31-54). The information in the charts is summarized in a form the reader may find convenient in Tables 16 and 17.

The findings for high school size demonstrate a much more consistent pattern than those for expenditure. In general the size-performance relationship before the introduction of the three control variables is not very well defined. The functional relationship would appear either to be positive or the shape of a parabola of the general type defined by the quadratic $a + bx - cx^2$, (i.e., the shape of an inverted shallow bowl.) With the introduction of intelligence, socio-economic index, and high school expenditure into the multiple regression equation, however, the size-performance relationship becomes consistently negative with a functional shape that is almost always demonstrably linear.

A plausible explanation for the overall negative size finding is that it is due to differences in urban characteristics. In Part IV below there is evidence to show that the size-performance relationship <u>within</u> each of the four urbanness classifications is rarely significantly negative. If, on the other hand, it is possible to argue that these urbanness differences are themselves not important, then the tentative conclusion would have to be that, other things equal, increased school size is somehow detrimental to better school performance.[45]

The other interesting finding with respect to size is the difference in the relationship before and after the introduction of the three control variables. Thus many of the gross relationships, especially in grade 12, seem to attain a maximum at some size level in the neighborhood of 1200 to 1600 pupils in ADA and then to decline, while after the

---

[44] There are also some other differences in detail. Thus there are two changes in interval width along the size axis. The first 20 intervals each represent a width of 50 pupils in ADA up to the size of 1000. The next ten intervals are in widths of 100 pupils in ADA while the last 15 have widths of 200. In the analysis it was found that there were very few pupils in high schools which had more than 4000 pupils in ADA and therefore the size axis on the charts ends at that figure.

[45] The size findings in this study are very similar to findings obtained in an earlier study by the author of 97 school <u>districts</u> in New York State (Kiesling, <u>Review of Economics and Statistics</u>, <u>op. cit</u>.) In that study there was an overall negative relationship that could (but just barely) be explained away by differences in urban characteristics.

art 31

NINTH GRADE

ENGLISH

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

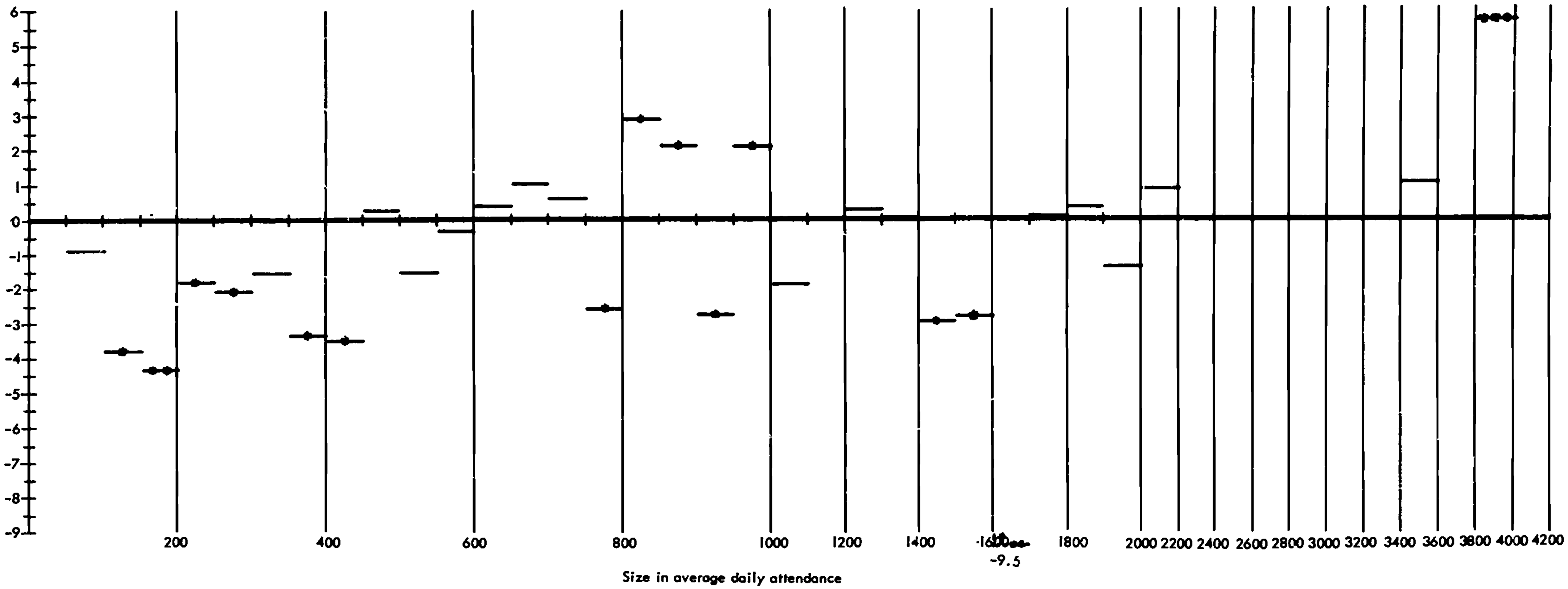
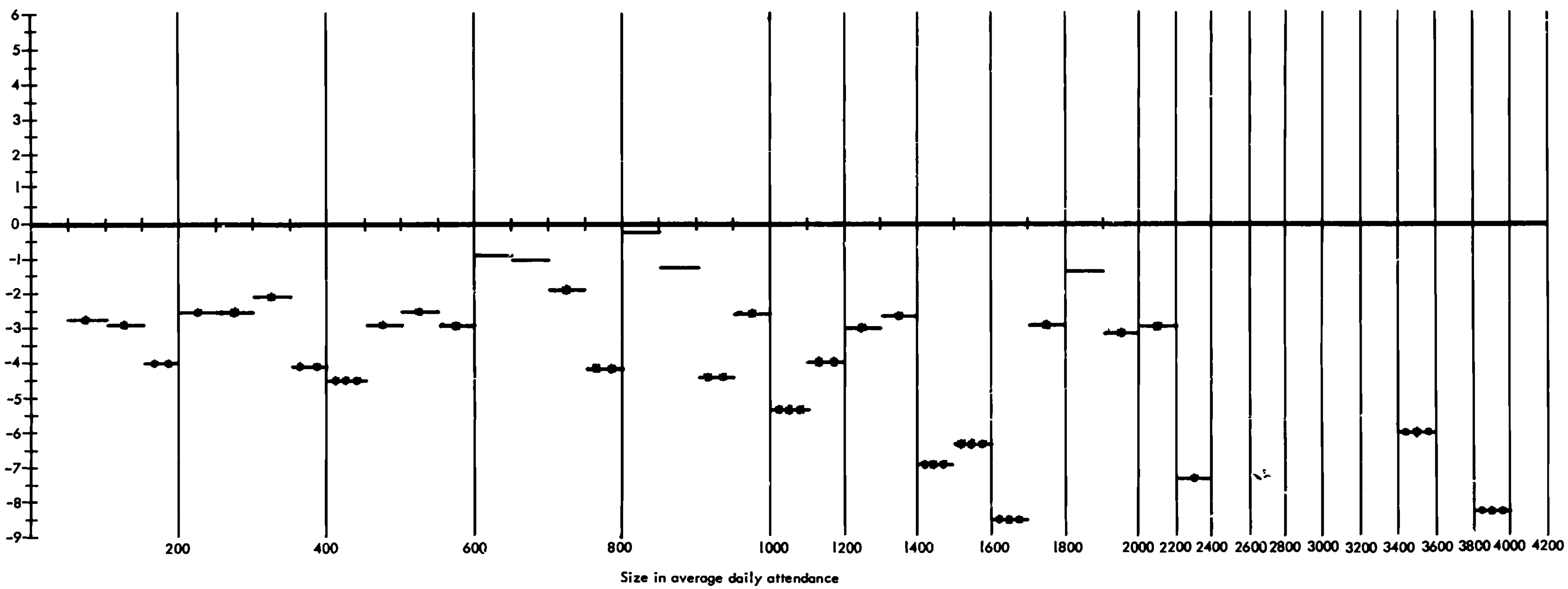


Chart 32

NINTH GRADE

ENGLISH

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 31-54 appear on page 90

Chart 33

NINTH GRADE

MATHEMATICS

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

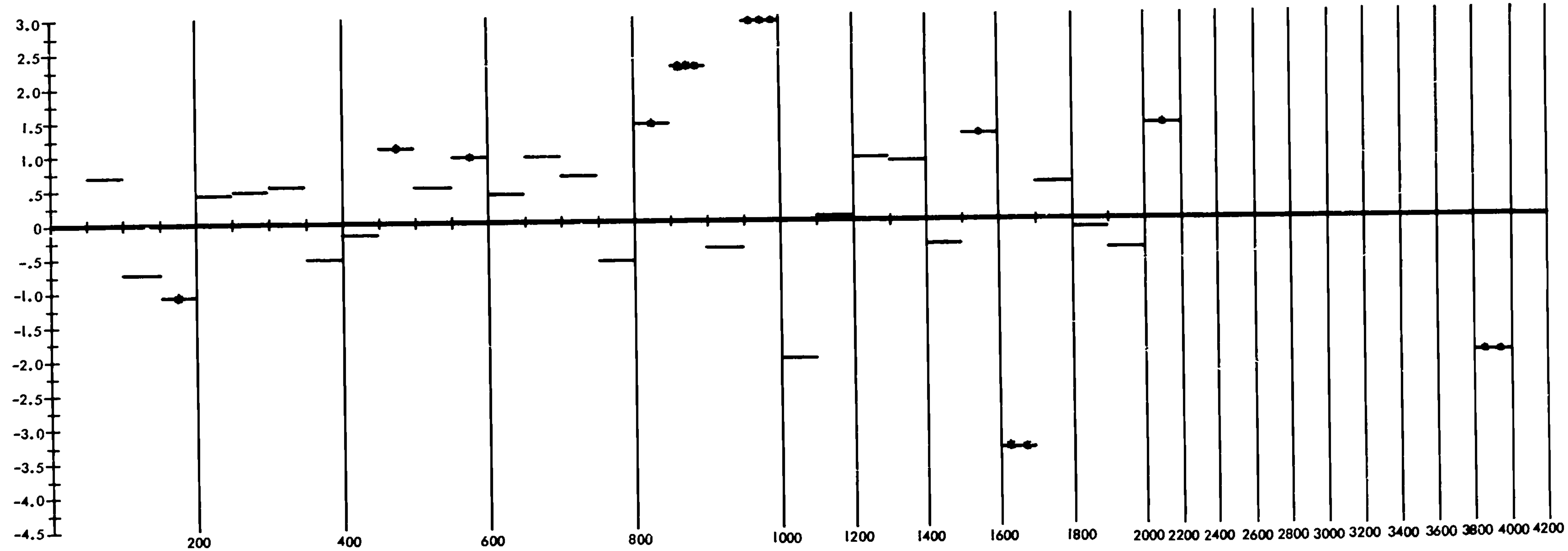
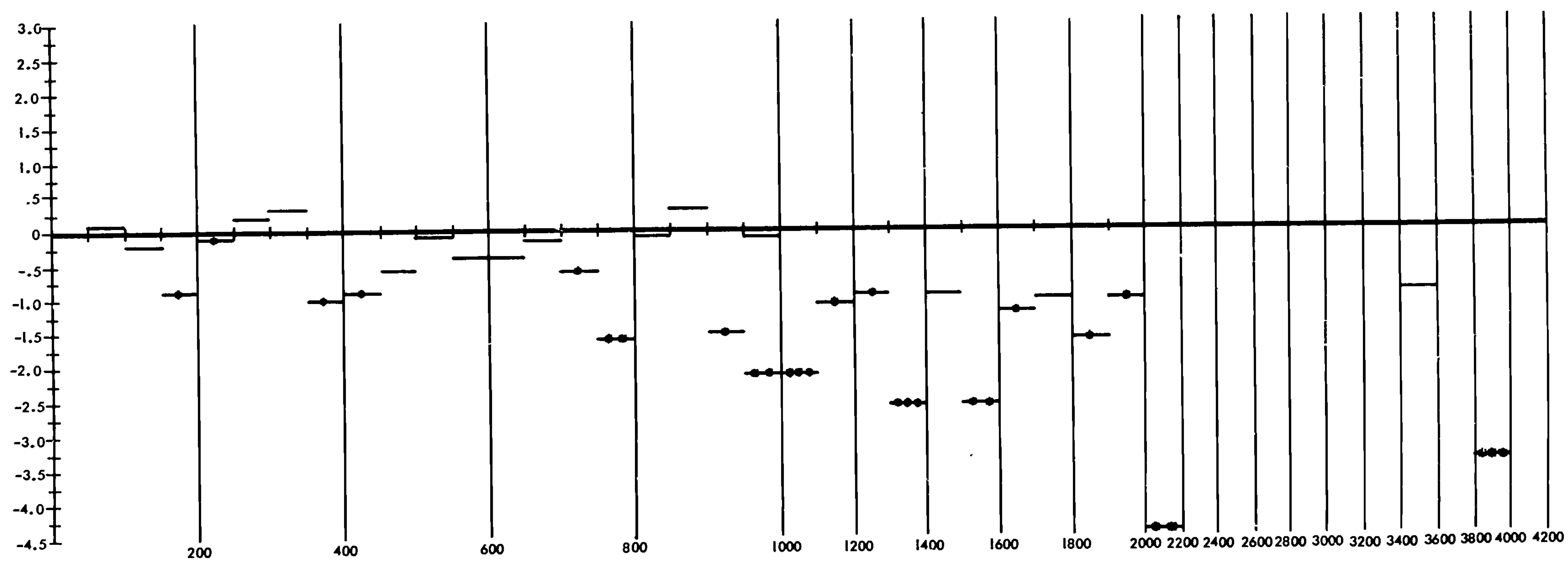


Chart 34

NINTH GRADE

MATHEMATICS

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 31-54 appear on page 90

art 35

NINTH GRADE

GENERAL SCHOOL APTITUDE

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

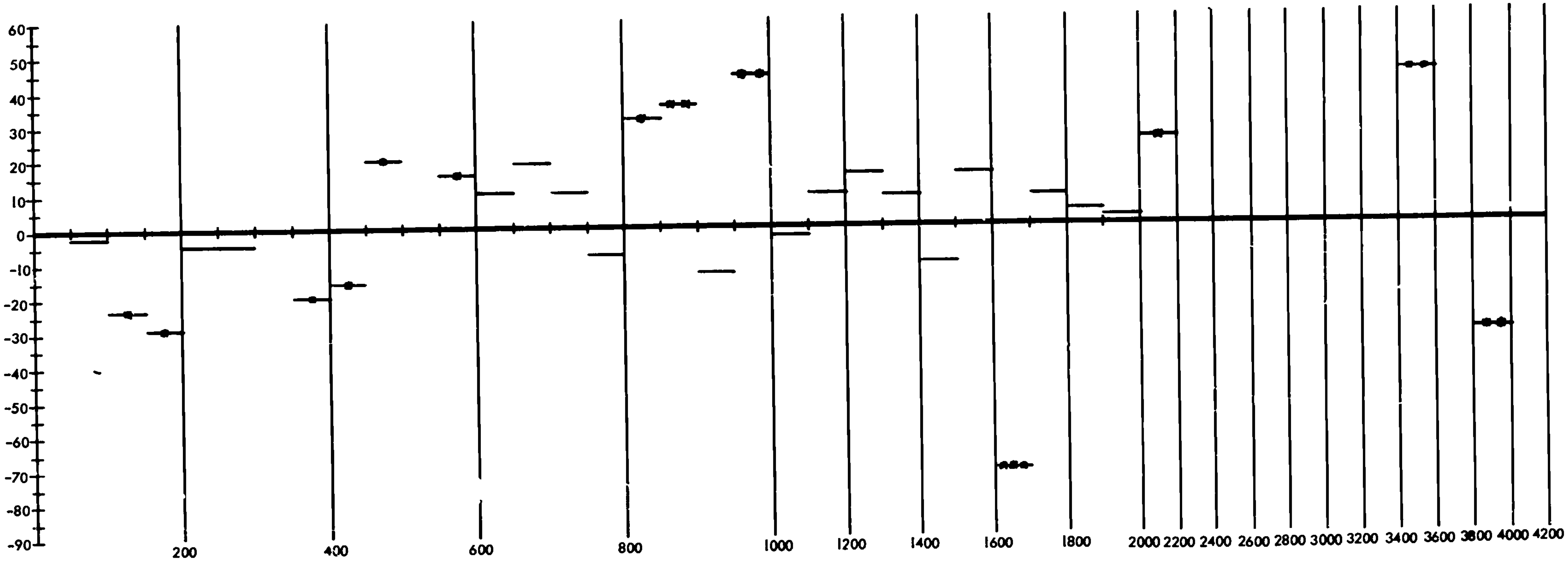
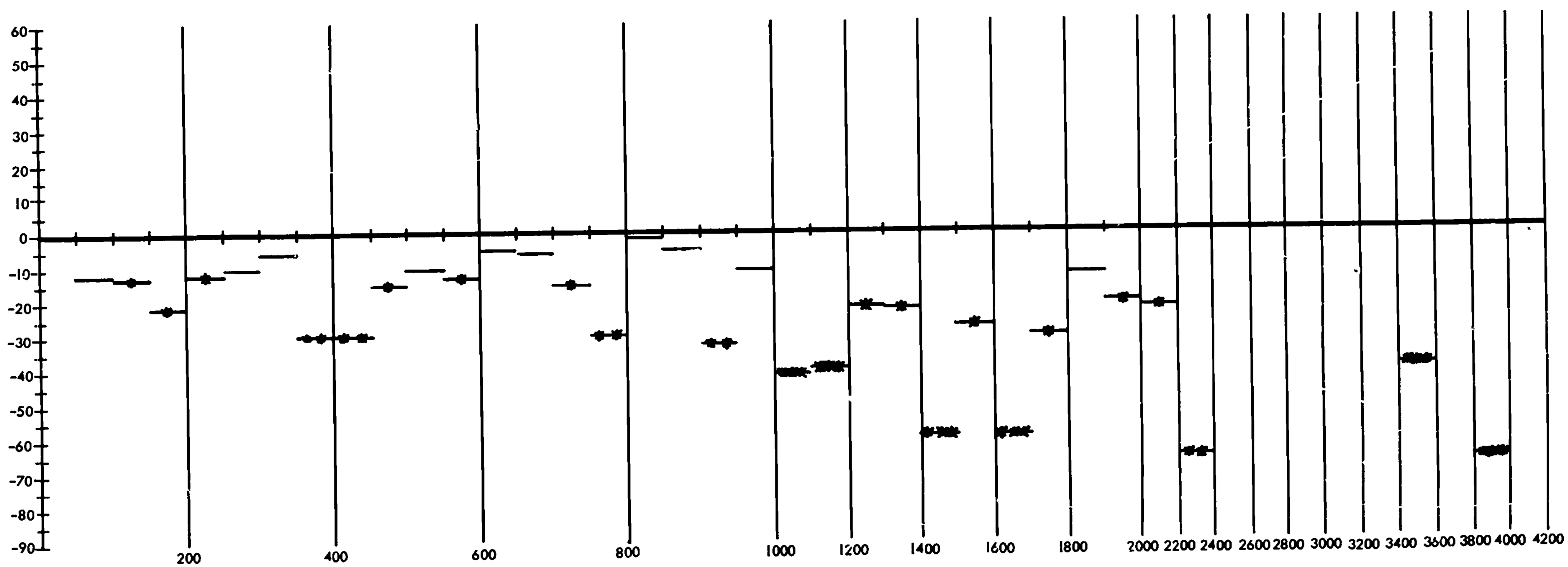


Chart 36

NINTH GRADE

GENERAL SCHOOL APTITUDE

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 31-54 appear on page 90

37

NINTH GRADE

GENERAL TECHNICAL APTITUDE

(No allowance made for
the effects of intelligence,
socio-economic background,
and high school size)

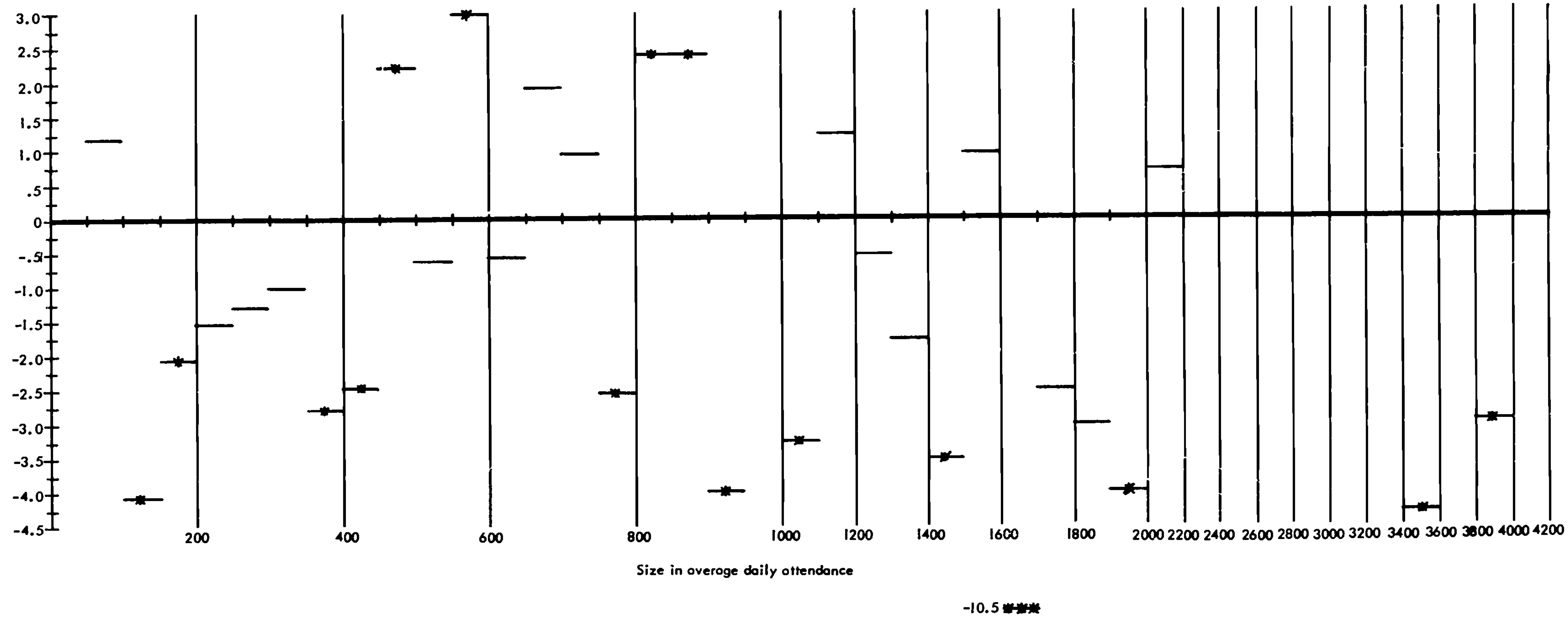
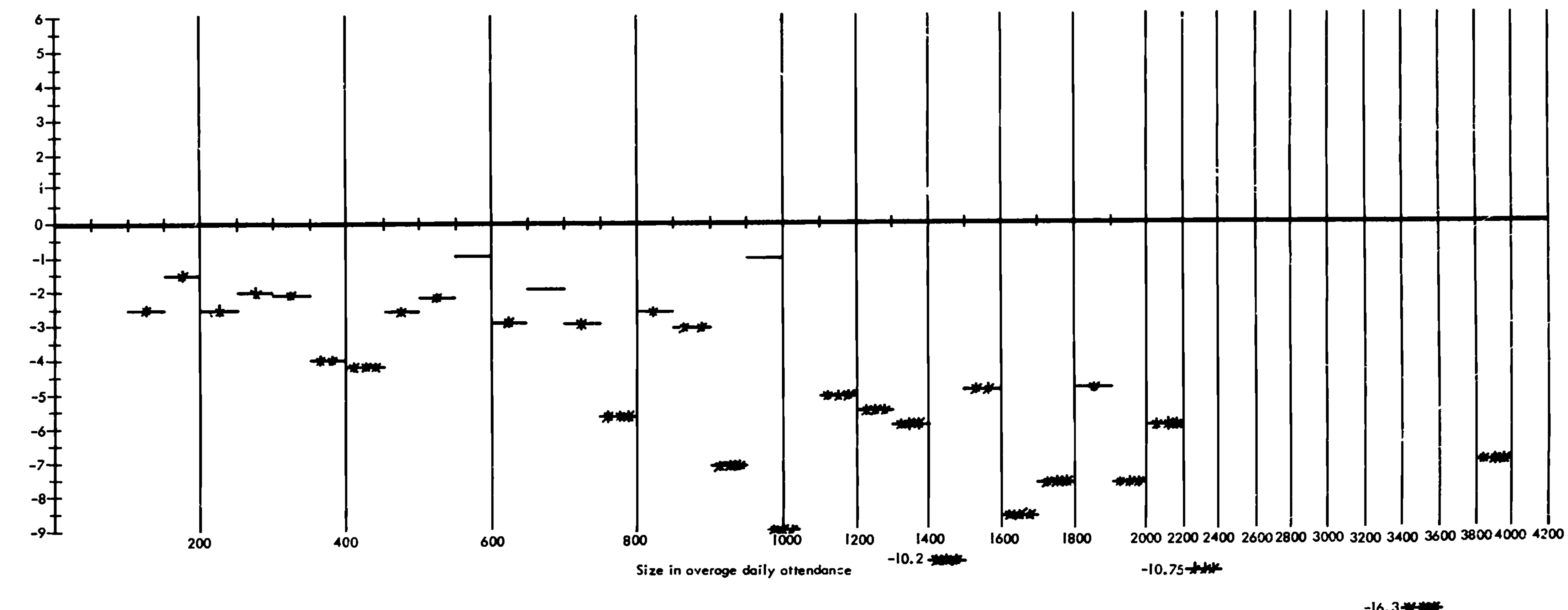


Chart 38

NINTH GRADE

GENERAL TECHNICAL APTITUDE

(Net of the effects of intelligence,
socio-economic background,
and high school size)



Notes to Charts 31-54 appear on page 90

Chart 39

NINTH GRADE

ENGLISH FACTOR SCORE

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

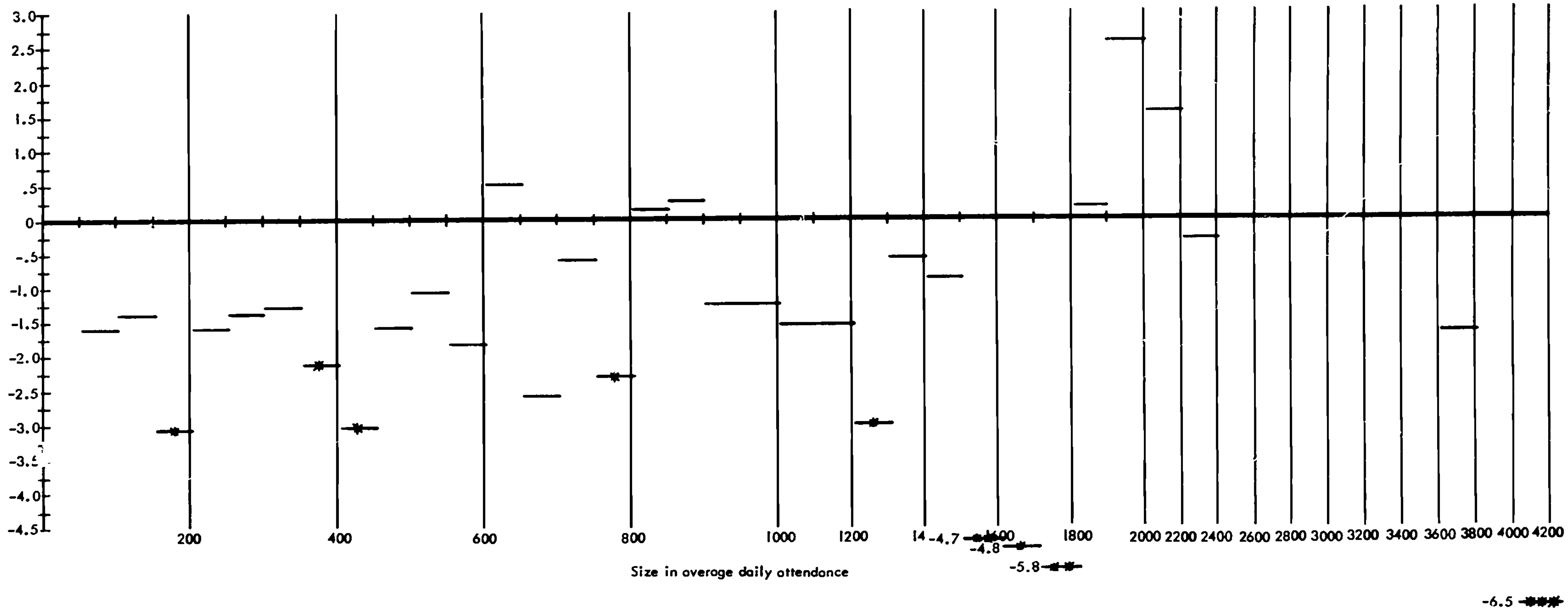
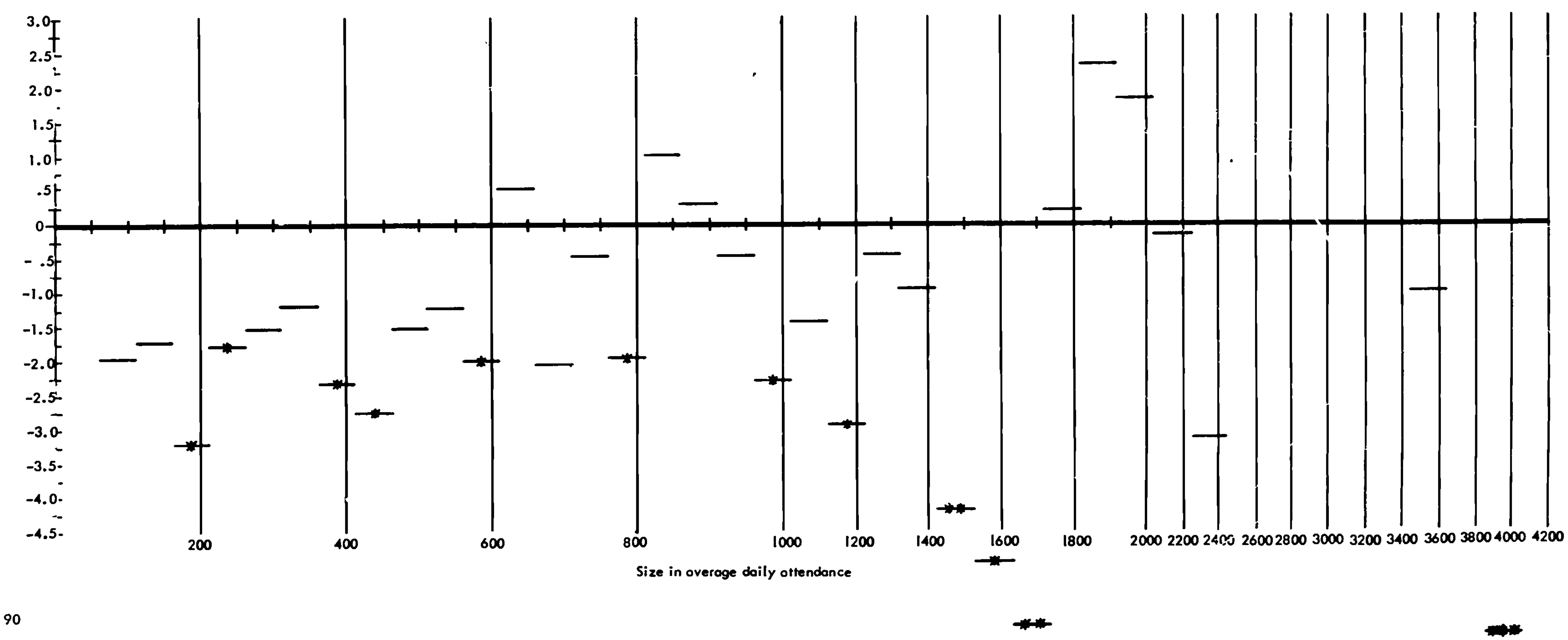


Chart 40

NINTH GRADE

ENGLISH FACTOR SCORE

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 31-54 appear on page 90

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NINTH GRADE

MATHEMATICS FACTOR SCORE

(No allowance made for
the effects of intelligence,
socio-economic background,
and high school size)

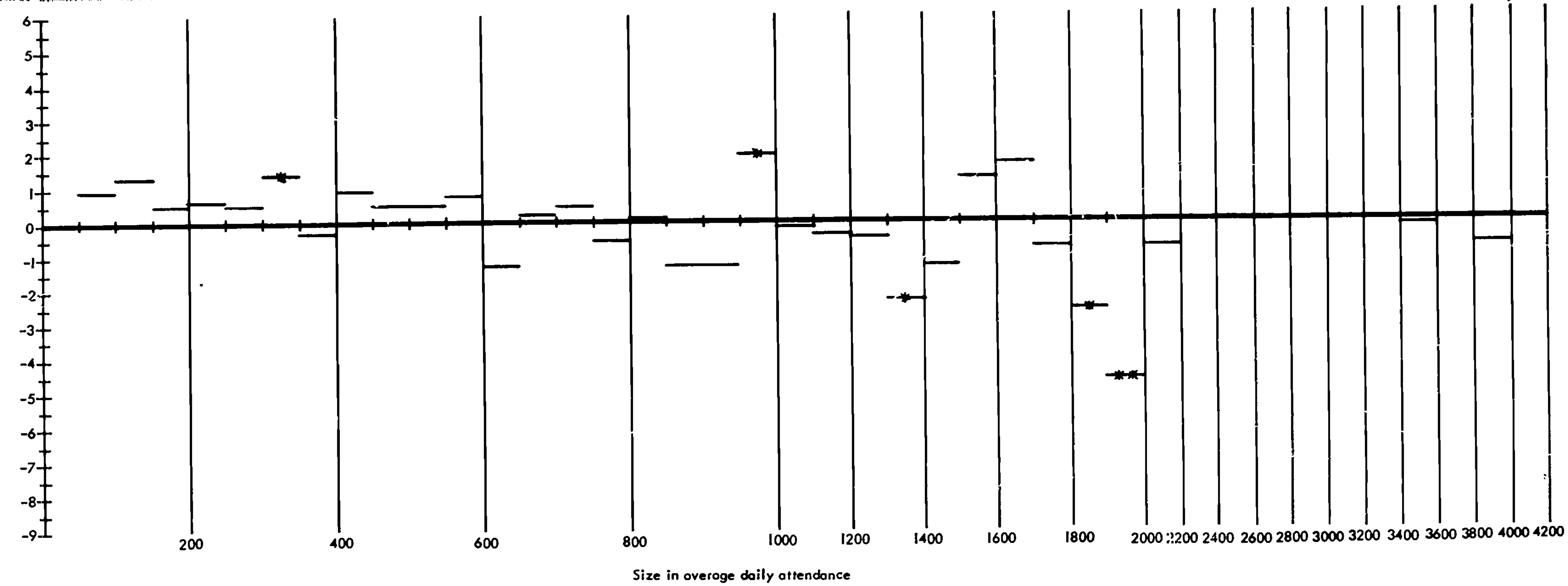
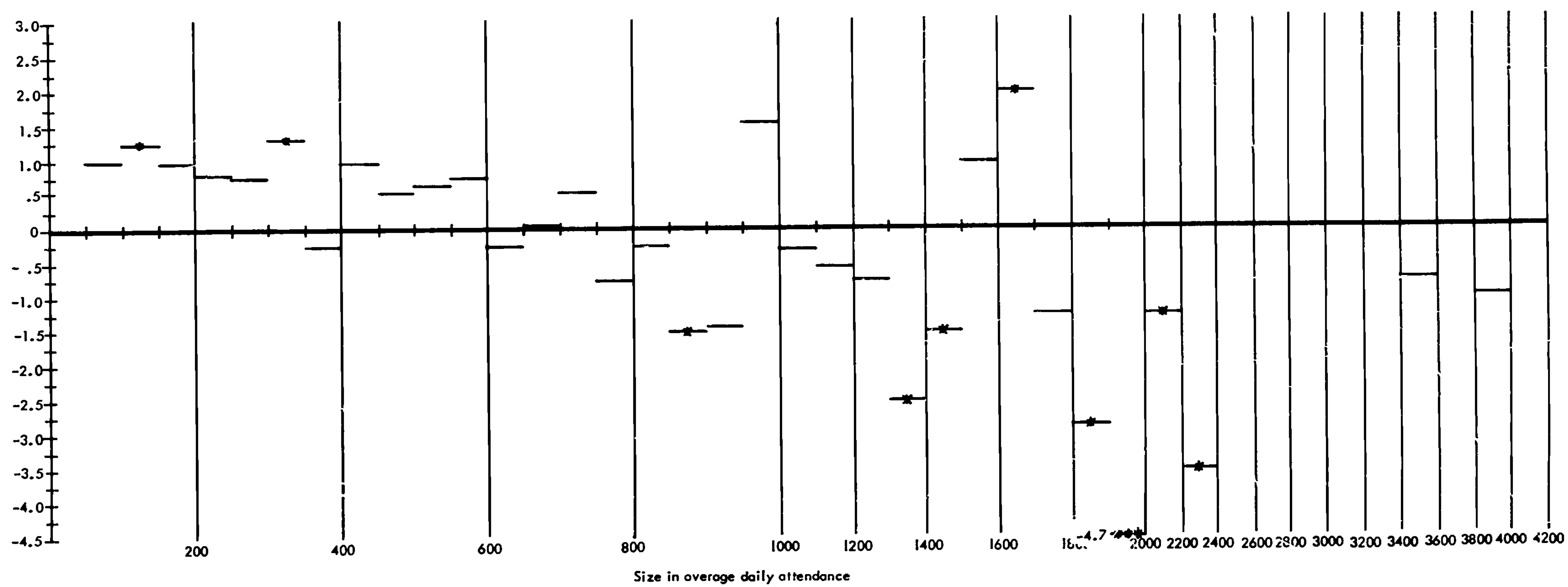


Chart 42

NINTH GRADE

MATHEMATICS FACTOR SCORE

(Net of the effects of intelligence,
socio-economic background,
and high school size)



Notes to Charts 31-54 appear on page 90

art 43

TWELFTH GRADE

ENGLISH

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

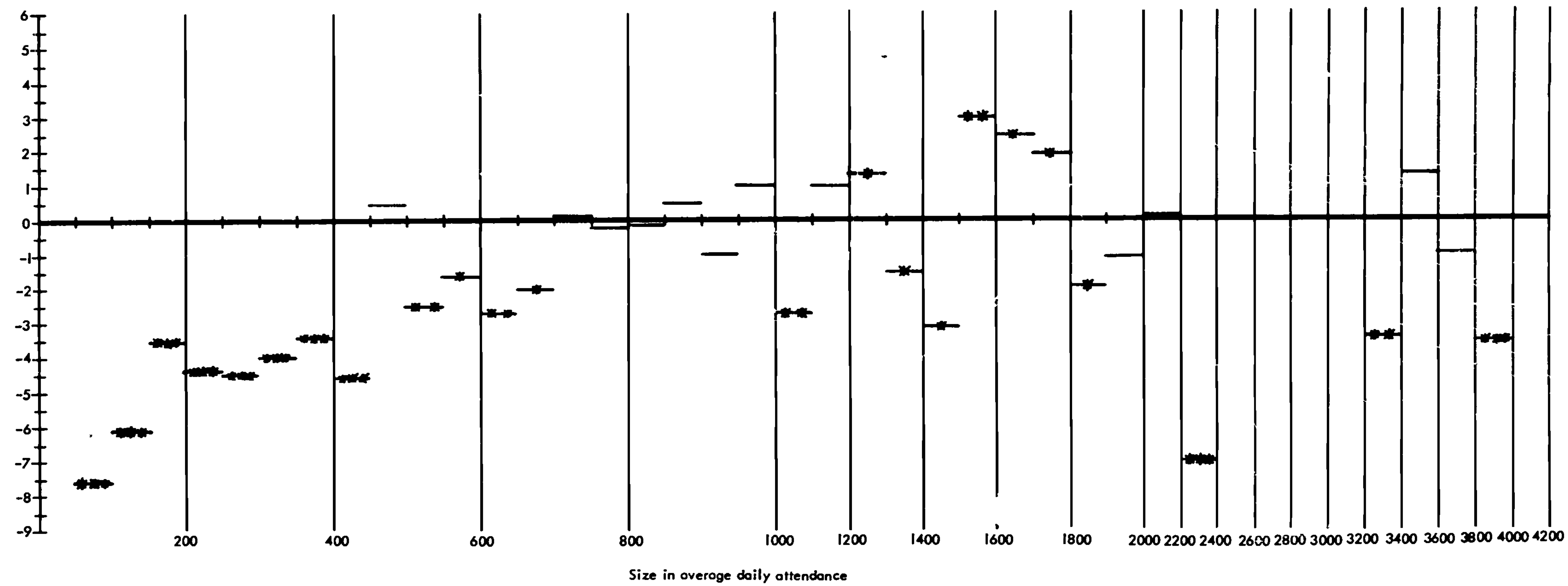
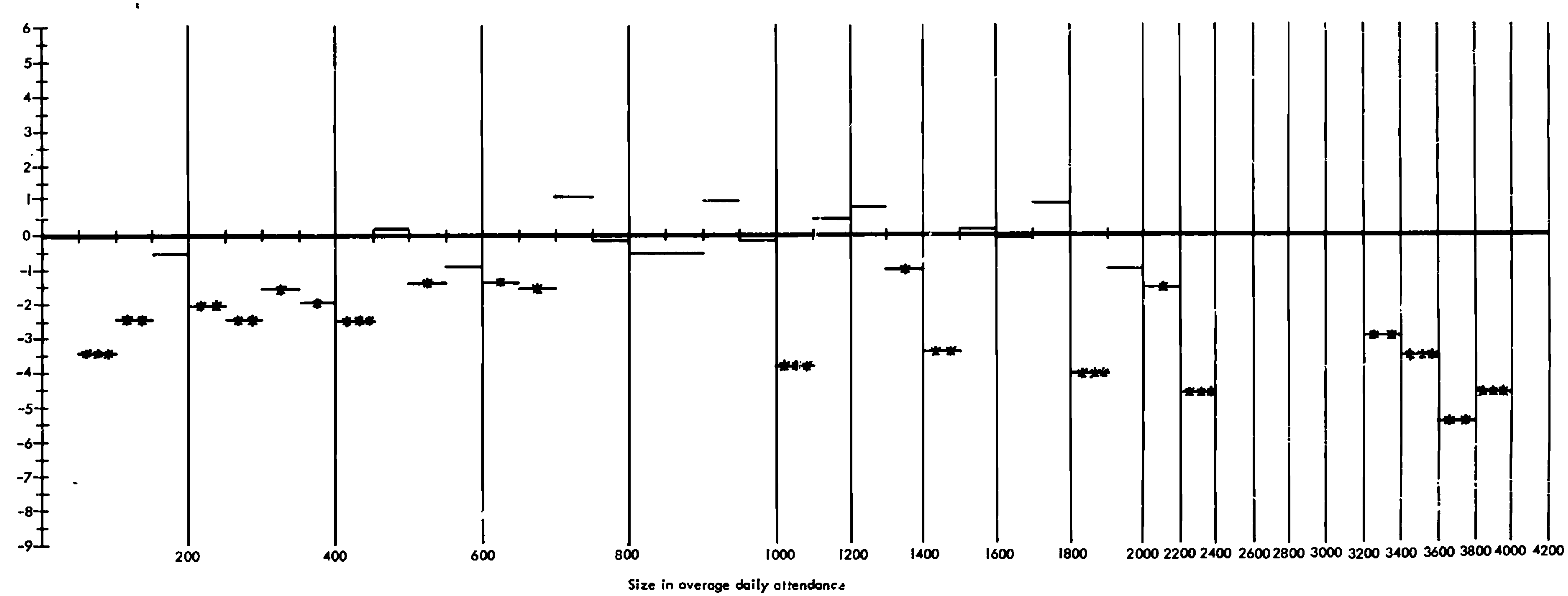


Chart 44

TWELFTH GRADE

ENGLISH

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 31-54 appear on page 90

hart 45

TWELFTH GRADE

MATHEMATICS

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

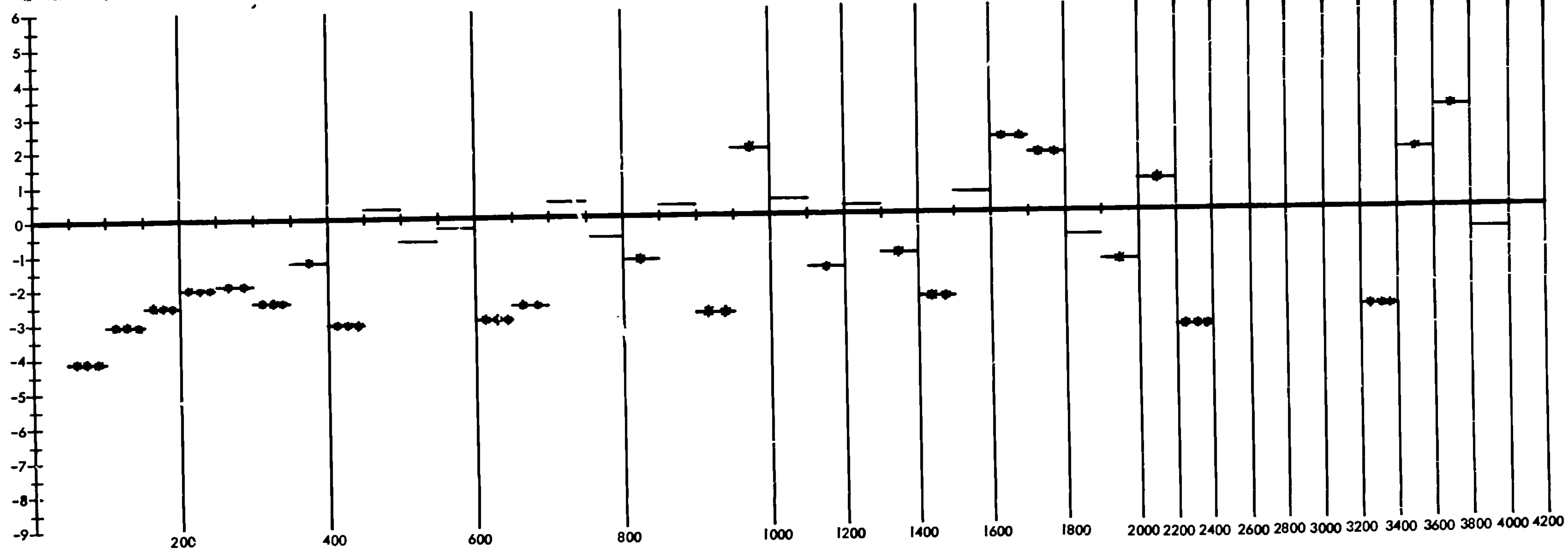
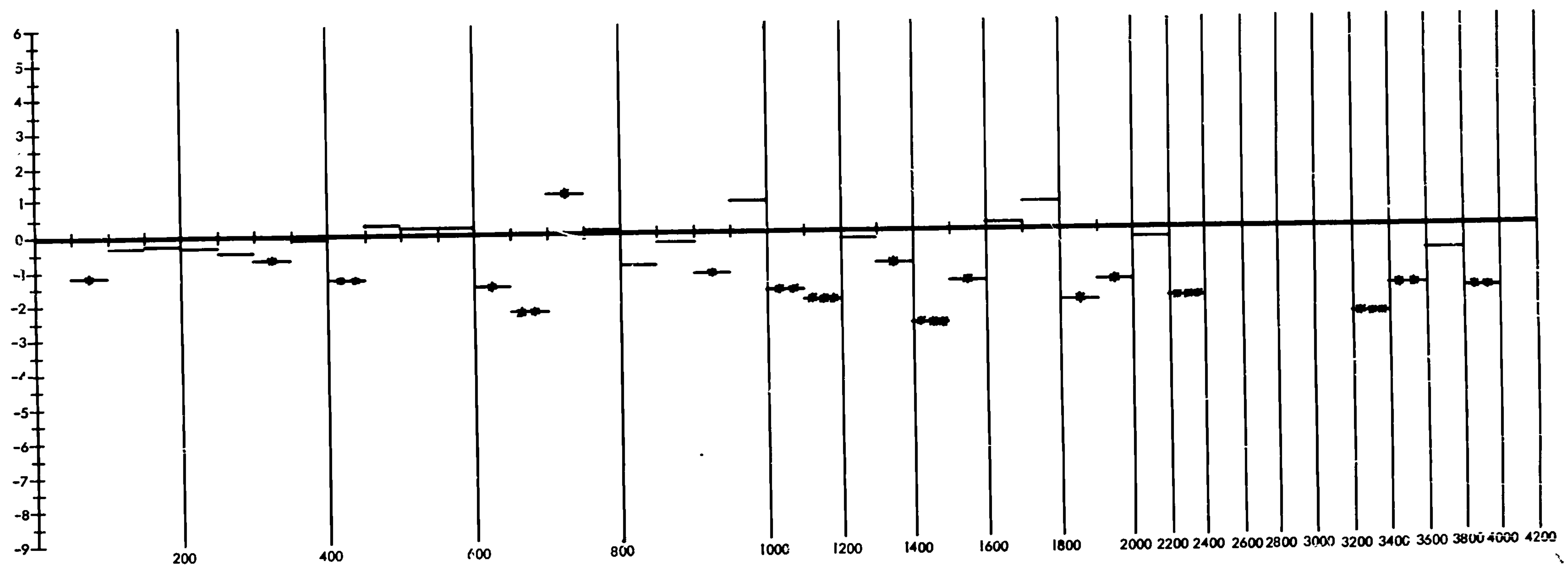


Chart 46

TWELFTH GRADE

MATHEMATICS

(Net of the effects of intelligence, socio-economic background, and high school size)



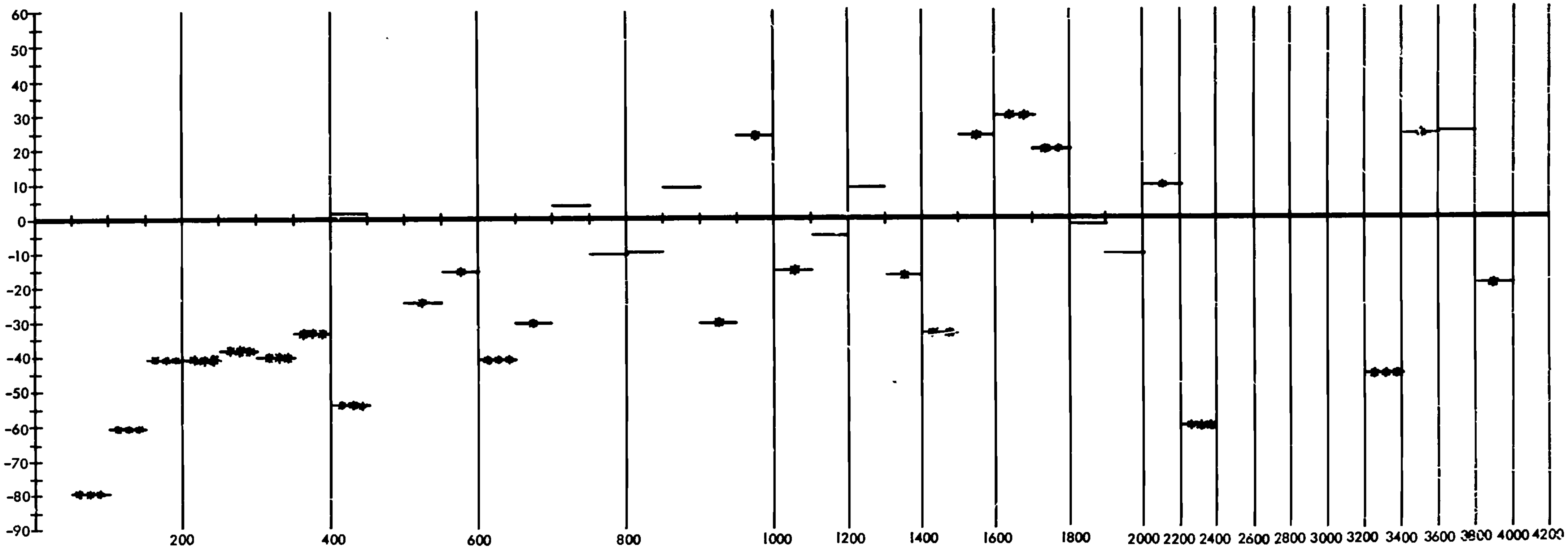
Notes to Charts 31-54 appear on page 90

C

TWELFTH GRADE

GENERAL SCHOOL APTITUDE

(No allowance made for
the effects of intelligence,
socio-economic background,
and high school size)



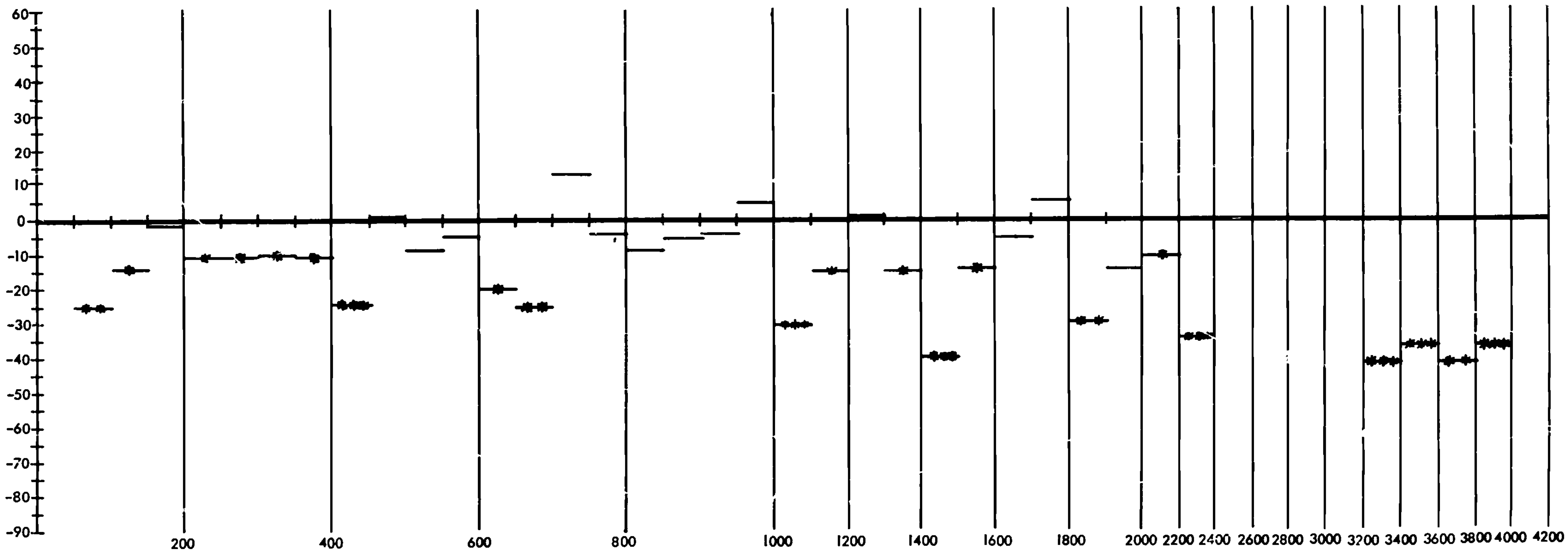
Size in average daily attendance

Chart 48

TWELFTH GRADE

GENERAL SCHOOL APTITUDE

(Net of the effects of intelligence,
socio-economic background,
and high school size)



Size in average daily attendance

Notes to Charts 31-54 appear on page 90

Chart 49

TWELFTH GRADE

GENERAL TECHNICAL APTITUDE

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

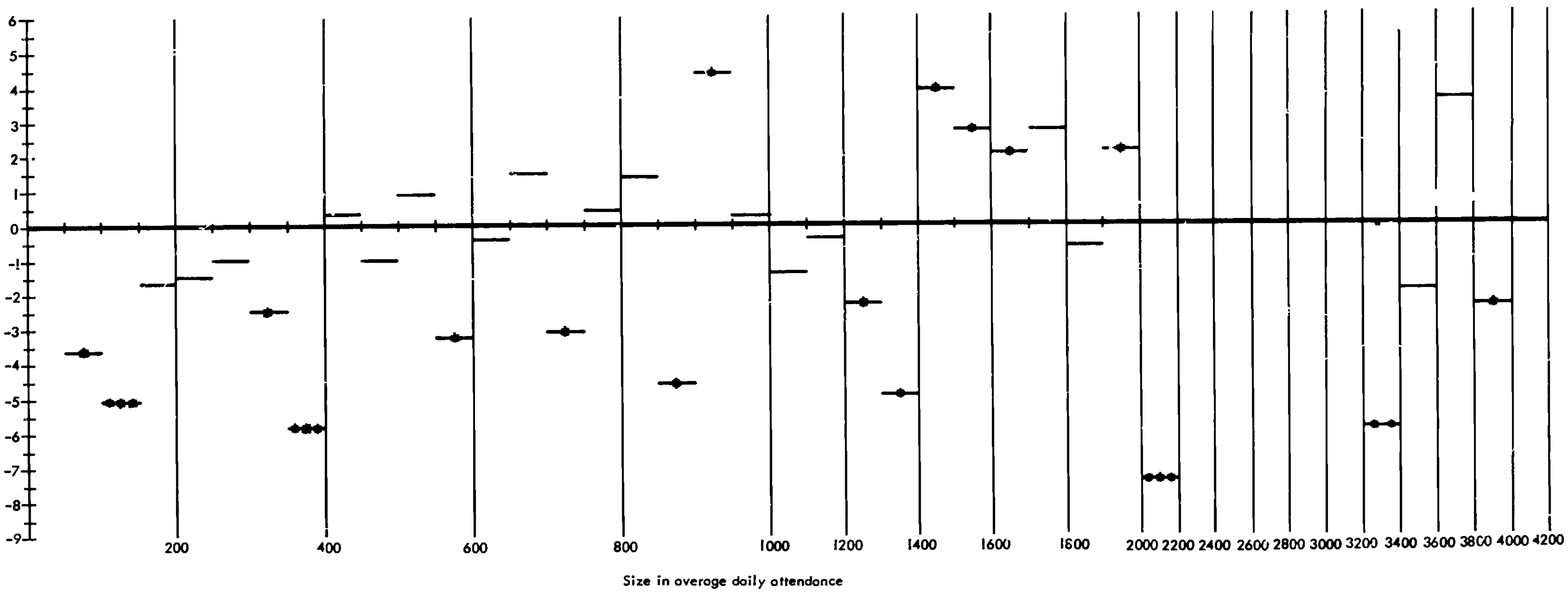
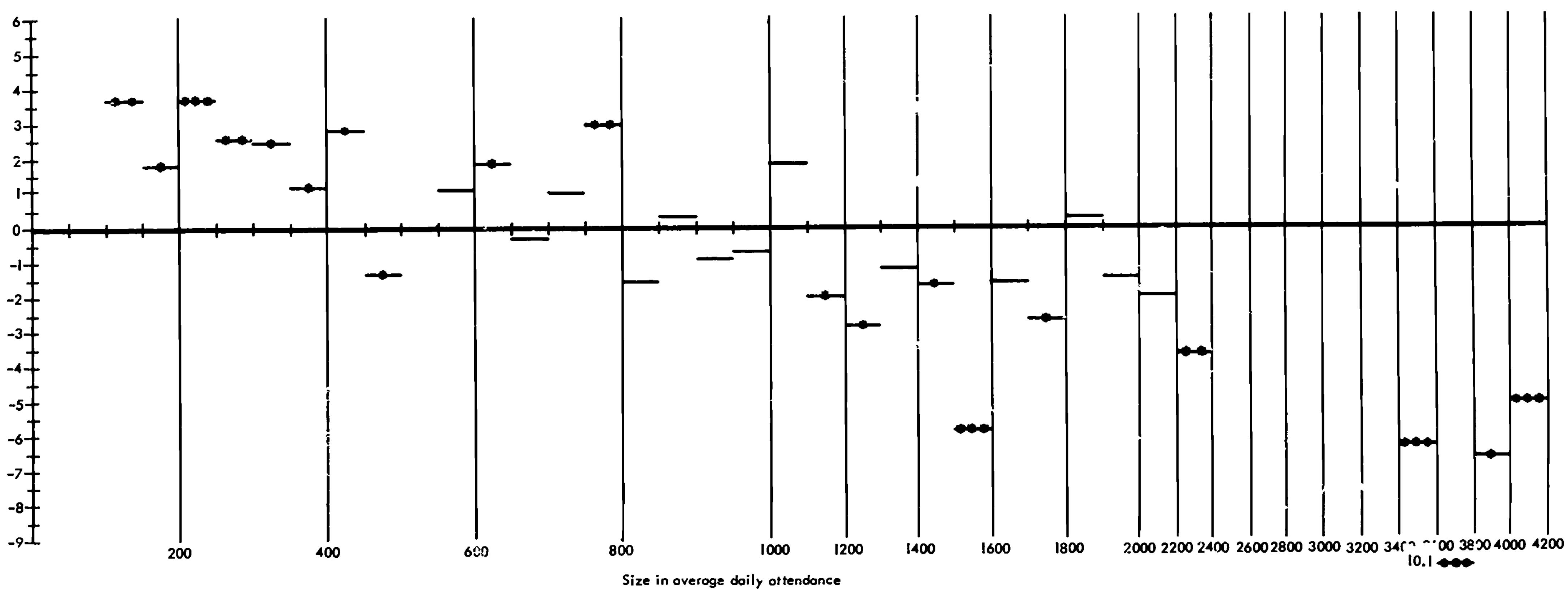


Chart 50

TWELFTH GRADE

GENERAL TECHNICAL APTITUDE

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 31-54 appear on page 90

Chart 51

TWELFTH GRADE

ENGLISH FACTOR SCORE

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

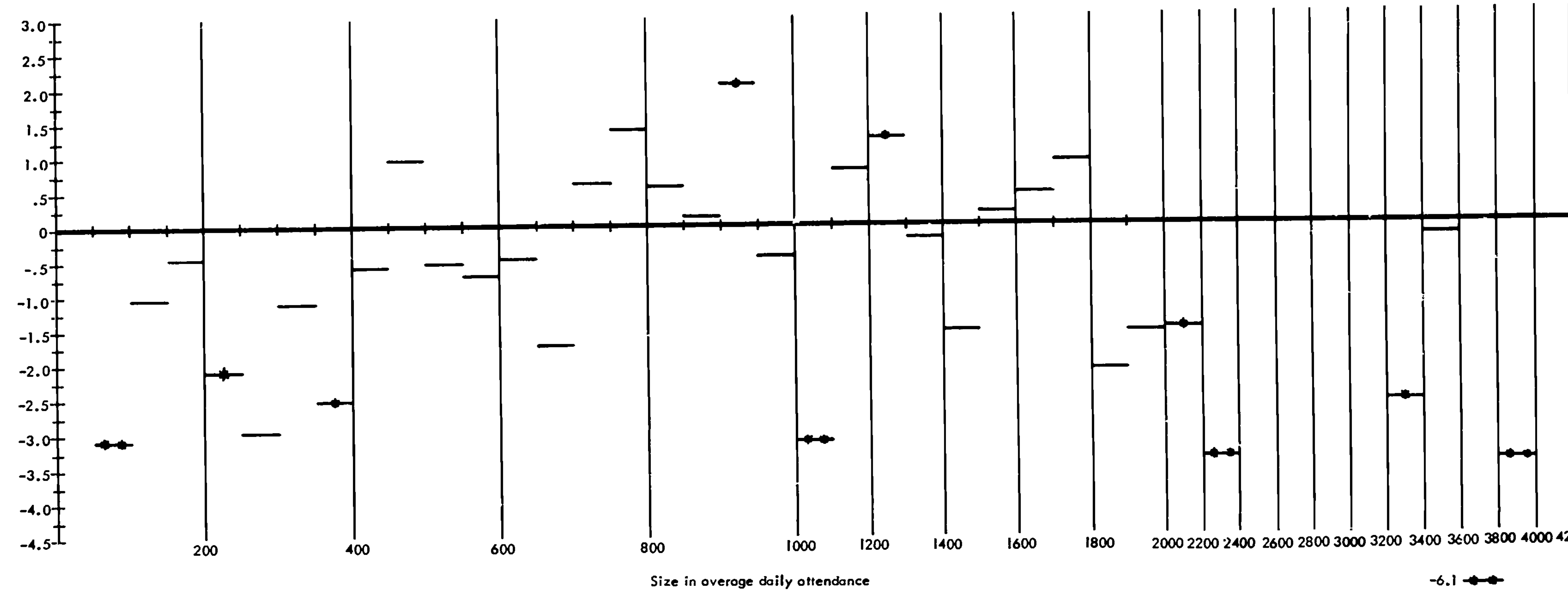
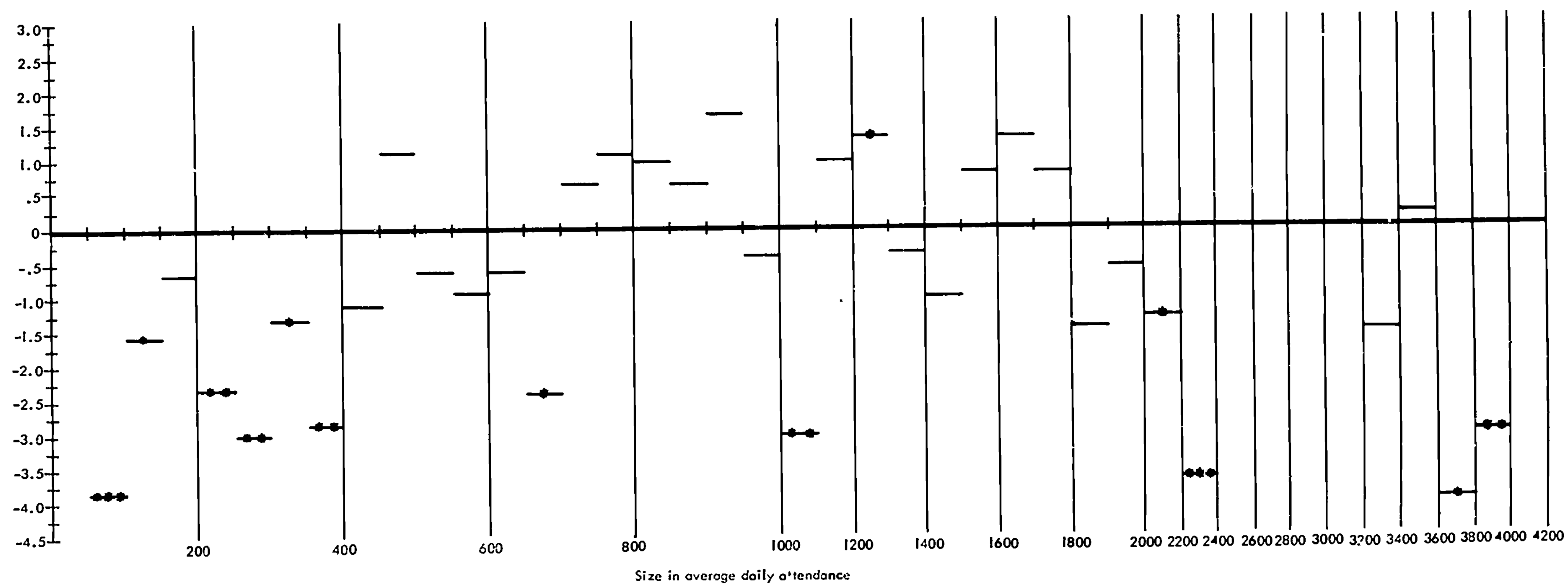


Chart 52

TWELFTH GRADE

ENGLISH FACTOR SCORE

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 31-54 appear on page 90

Chart 53

TWELFTH GRADE

MATHEMATICS FACTOR SCORE

(No allowance made for the effects of intelligence, socio-economic background, and high school size)

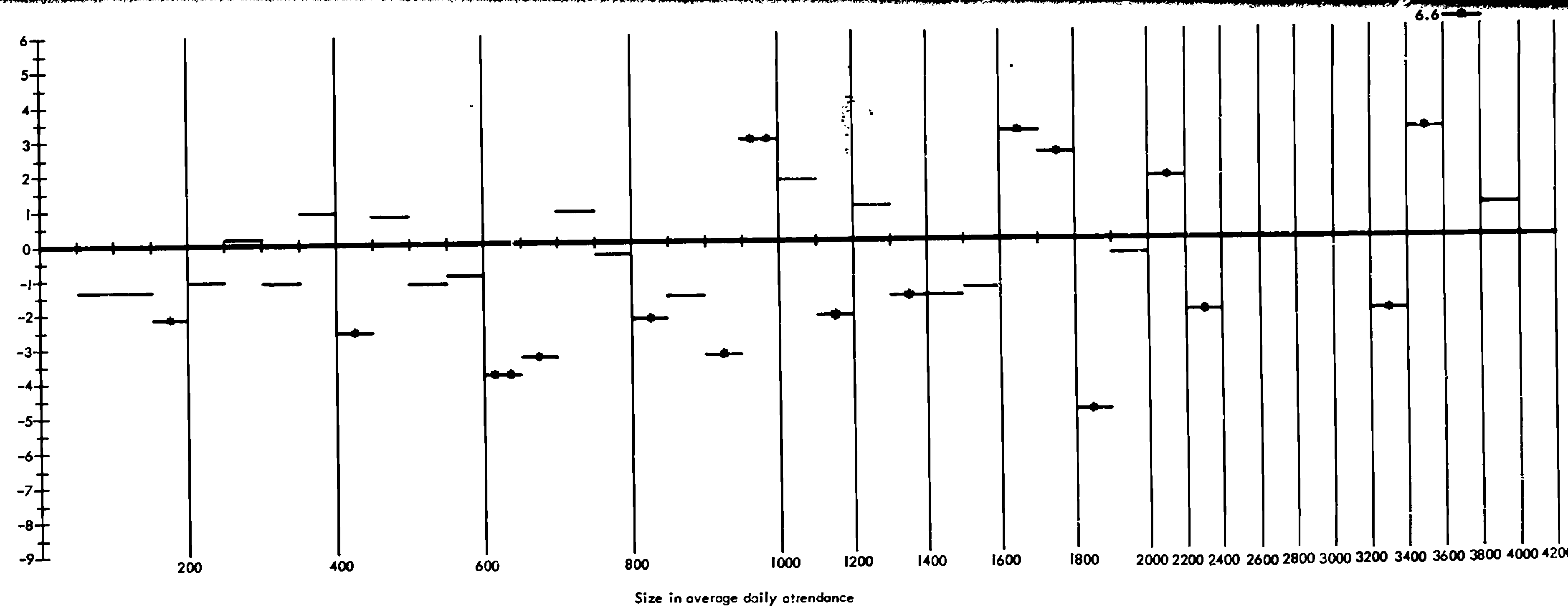
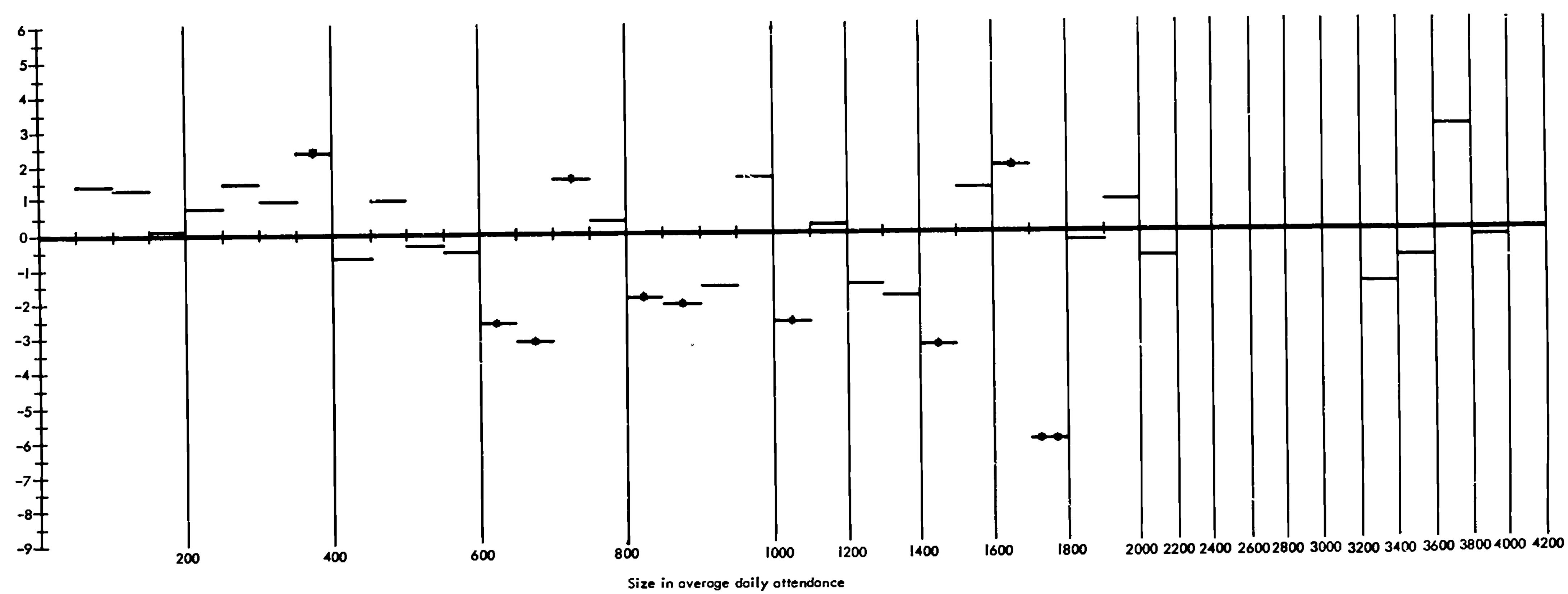


Chart 54

TWELFTH GRADE

MATHEMATICS FACTOR SCORE

(Net of the effects of intelligence, socio-economic background, and high school size)



Notes to Charts 31-54 appear on page 90

Notes, Charts 31-54

Description: Dummy Variables

See notes to Charts 1-24, page 60.

Statistical Significance

—*— = Significant at 90%
—**— = Significant at 95%
—***— = Significant at 99%

See also notes to Charts 1-24, page 60.

Beta Coefficients

The values given in the charts are b-weights and not beta coefficients. To give the reader an idea of the relative magnitude of the effects, the following standard deviations are provided:

	Grade 9	Grade 12
English	13.5	12.0
Mathematics	6.5	8.2
General School Aptitude	111.4	117.9
General Technical Aptitude	15.4	18.5
English Factor Score	10.3	9.8
Mathematics Factor Score	9.5	10.4

Number of Observations

The number of pupils in Grade 9 was 5,122 and in Grade 12, 5,692. Dummy variables for which there were fewer than 20 pupils have been omitted from the charts.

Size of Intervals

It was convenient to group the high schools into size intervals which were not of equal width. Therefore the number of pupils included in each dummy variable range changes twice over the size range on the charts. Interval size below 1000 pupils in average daily attendance is 50 pupils. Between 1000 and 2000 pupils in ADA the interval is 100 pupils, while the interval is 200 for sizes above 2000. The reader should make a mental recalculation in reading the charts, therefore, imagining the distances from 0 to 1000 pupils and from 2000 to 4000 pupils as half as large and twice as large, respectively.

There were very few pupils in high schools larger than 4200 in ADA and therefore sizes above that level were omitted from the charts.

TABLE 16

SUMMARY OF DUMMY VARIABLE FINDINGS
COMPARED TO COMPUTED SLOPE COEFFICIENTS,
SIZE-PERFORMANCE RELATIONSHIP, SIX QUALITY MEASURES, GRADE 9

Quality Measure	Relationship				
	How Well Defined	Statistical Significance	Estimated Beta Coefficient	Computed Beta Coefficient	t-value of Computed Beta Coefficient
English, Gross	Undefined	Fair	--	nc	nc
English, Net	Fair-Good	Good	-.145	-.059	4.51
Mathematics, Gross	Fair	Fair	Non-linear	nc	nc
Mathematics, Net	Fair-Good	Fair	-.145	-.082	6.63
School Aptitude, Gross	Poor	Poor	Non-linear	nc	nc
School Aptitude, Net	Fair	Fair	-.129	-.077	6.75
Technical Aptitude, Gross	Undefined	Fair	--	nc	nc
Technical Aptitude, Net	Good	Good	-.197	-.141	12.96
English Factor, Gross	Undefined	Poor	--	nc	nc
English Factor, Net	Poor	Fair	-.071	-.013	0.91
Mathematics Factor, Gross	Undefined	Poor	--	nc	nc
Mathematics Factor, Net	Fair	Fair	-.159	-.070	4.83

NOTES: Notes to Tables 16 and 17 appear on page 93.

TABLE 17

SUMMARY OF DUMMY VARIABLE FINDINGS
COMPARED TO COMPUTED SLOPE COEFFICIENTS,
SIZE-PERFORMANCE RELATIONSHIP, SIX QUALITY MEASURES, GRADE 12

Quality Measure	Relationship				
	How Well Defined	Statistical Significance	Estimated Beta Coefficient	Computed Beta Coefficient	t-value of Computed Beta Coefficient
English, Gross	Good	Good	.087	nc	nc
English, Net	Fair	Good	-.052	-.030	2.47
Mathematics, Gross	Poor	Fair	.104	nc	nc
Mathematics, Net	Fair-Good	Good	-.079	-.036	2.96
School Aptitude, Gross	Good	Good	.120	nc	nc
School Aptitude, Net	Good	Good	-.107	-.046	4.34
Technical Aptitude, Gross	Poor	Poor	.065	nc	nc
Technical Aptitude, Net	Good	Good	-.183	-.120	10.72
English Factor, Gross	Undefined	Poor	--	nc	nc
English Factor, Net	Undefined	Poor	--	nc	nc
Mathematics Factor, Gross	Poor	Fair	.065	nc	nc
Mathematics Factor, Net	Poor	Poor	.000	-.003	0.25

NOTES: Notes to Tables 16 and 17 appear on page 93.

Notes, Tables 16 and 17

Meaning of Gross and Net

"Gross" means that the dependent variable is explained by the size dummy variables without allowance being made for the effects of school expenditure per pupil, pupil intelligence (Verbal Knowledges Factor Score), and pupil socio-economic index. "Net" means that such allowance has been made.

Definition of Function

This is a subjective estimate by the author of how sharply the function represented under "Function Shape" is traced by the successive values for the dummy variable expenditure intervals. Thus, if a function is discernible but the plotted dummy ariables often deviate from the function, it might be described as being "poor", etc.

Statistical Significance

This is an estimate of the overall statistical significance of the function made from the number of individual dummy variables which were statistically significant.

Estimated and Computed Beta Coefficients

The estimated beta coefficient is that for a hand-fitted line to the function on the assumption that the function is linear. The computed beta coefficient is that computed for the expenditure-performance relationship when the continuous expenditure variable is used.

nc = not computed.

three control variables are introduced, the entire relationship becomes negative and linear. A possible explanation for this is that medium-sized schools exhibit better performance because they have pupils who are either more intelligent or come from better socio-economic backgrounds, or both. If this were true, the introduction of the intelligence and socio-economic variables would have the effect of producing the observed phenomenon.

IV

THE EXPENDITURE AND SIZE RELATIONSHIPS CONTINUED: REGIONAL AND URBANNESS EFFECTS

Thus far the findings in this report have been given with respect to all of the public general comprehensive and college preparatory high schools in the Project Talent Sample. The task of Part IV will be to examine whether any of these findings could be due to differences in the regional and urban settings in which the high schools are found.

Project Talent divided their sample into six regions and four classifications according to urbanness. Some key characteristics of the six regions are included in Table 18. From a careful perusal of the information in that table, it would appear that there is little difference between the regions except for the 12 Southeastern states where average expenditure, intelligence, and performance levels are much lower.[46] The only regional difference with respect to size which seems noteworthy is that high schools in the Atlantic states were a great deal larger than in other regions.

The four urbanness categories used by Project Talent are Large City, Urban, Rural, and Small Town. Characteristics for these four categories are summarized in Table 19. It is interesting that the urban districts appear to be getting the most in return for their money as they have the highest average figures for performance and the lowest figure for average expenditure per pupil. This is at least in part due to socio-economic differences as the reader can see by examining the average figures for the socio-economic index included in the table. The value for urban districts is much higher in the 9th grade, which is probably the important grade for such a calculation since drop-outs have not yet occurred.[47] Other differences between the four urban categories are not as pronounced although the rural high schools perform on the average somewhat more poorly and the large cities spend approximately $100 per pupil more than the other three categories. There are great size differences, of course, which are only to be expected from the nature of the breakdown.

In the remainder of Part IV regional and urban differences are analyzed in two ways. First, individual pupils will be used as

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[46]The high schools in the Rocky Mountain states also had much lower scores for intelligence and achievement performance, although, with only 13 observations, this cannot be assigned much importance.

[47]With respect to drop-outs it is interesting that the average value of the socio-economic index increases a great deal more from grade 9 to grade 12 in the large cities than in the other three categories. This probably means that there are a great many more drop-outs in the large city high schools. In any event, unless great pains were taken to strictly account for differences in drop-out rates,

TABLE 18

CHARACTERISTICS OF THE PROJECT TALENT HIGH SCHOOLS WHEN CONSIDERED ACCORDING TO REGION

Region	Characteristic						
	Number of Schools	Mean Size (ADA)	Standard Deviation: Mean Size	Mean Expenditure ($)	Standard Deviation: Mean Expenditure ($)	Mean School Aptitude Score, Grade 9	Stand Deviat Scho Aptit Scor
Northeast	26	635	520	$415	$104	576	49
Atlantic	108	1690	1590	$511	$139	536	72
Great Lakes	111	583	740	$383	$114	530	63
Plains	81	302	363	$455	$158	529	74
Southeast	147	368	382	$217	$176	457	113
Southwest	40	491	638	$357	$154	506	110
Mountain	13	414	575	$338	$ 61	461	209
Far West	26	713	660	$525	$120	516	117

TABLE 19

CHARACTERISTICS OF THE PROJECT TALENT HIGH SCHOOLS WHEN CONSIDERED ACCORDING TO URBAN TYPE

Characteristic	Urban Type			
	Large Cities	Urban	Rural	Small Town
Total Number	94	181	164	196
Mean Size in ADA	2482	686	191	245
Standard Deviation of Mean Size	1316	468	168	146
Mean Expenditure per Pupil	$495	$340	$352	$391
Standard Deviation of Mean Expenditure	$93	$133	$183	$162
Mean Score, General School Aptitude, Grade 9	416	441	411	438
Standard Deviation, General School Aptitude	84	68	97	79
Mean Value, Project Talent, Socio-Economic Index, Grade 9	95.0	97.2	90.2	93.6
Mean Value, Project Talent, Socio-Economic Index, Grade 12	99.4	98.0	91.2	94.5
Standard Deviation, Socio-Economic Index, Grade 9	13.0	6.3	14.9	9.5

observations and attention given to the differences in relationships which obtain because of differences in pupil socio-economic background. After this has been done, the high school will be used as the unit of observation and a detailed analysis will be performed complete with cross-classifications for seven quality measures for all pupils taken together.

Regional Differences: Individual Pupils as Observations

Tables 20 and 21 give findings for expenditure-performance relationships for four quality measures, Mathematics, General School Aptitude, General Technical Aptitude, and the Mathematics Factor score. Since the discussion in this section includes the socio-economic breakdown, it was considered appropriate to include the Technical Aptitude measure because it is possible that schools give some pupils, especially those from lower socio-economic backgrounds, good training in technical subjects even if not doing so in academic subjects. As the reader will recall, this was found to be true for 12th grade children in the lowest father education category in the dummy variable analysis above.[48]

The regional breakdowns given in Tables 20 and 21 use three regions: Northeast (New England and Atlantic states), Southeast, and the Rest of the Country. These are the three breakdowns most often used by Project Talent and it is employed here, although the author feels, as previously discussed, that a two-fold breakdown--Southeast and Rest of the Country--is adequate. Such a two-region breakdown is used in the cross-classification analysis presented below.

As the reader can readily tell from an examination of Tables 20 and 21, making the regional breakdown has a large effect upon the computed significance of the expenditure-performance relationships, as almost all of the relationships shown are quite weak. The only consistent exception to this is the performance for pupils in the top two socio-economic quartiles in the Northeast. There are no relationships which are positive and statistically significant in the rest of the country. Nor is it true that "better" schools are teaching pupils in the bottom two quartiles more skills in technical subjects.

Size findings for the three regions are given for two of the measures in Table 22. In light of the overall negative relationships shown above, it is interesting that most of the significant or near-significant relationships in Table 22 are positive. Otherwise there is little that can be said about within-region size variations. One interesting point is that pupils in socio-economic quartile 3 seem to perform relatively better in larger high schools, especially in the Southeast.

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the 9th grade is much superior to the 12th for the calculation of socio-economic averages.

[48]The possibility that education in technical skills might be an important facet of education which is sometimes neglected was discussed in Part II.

TABLE 20

PERFORMANCE IN PROJECT TALENT HIGH SCHOOLS RELATIVE TO EXPENDITURE PER PUPIL BY REGION, GREAT LAKES, PLAINS, SOUTHEAST, FOUR SOCIO-ECONOMIC QUARTILES, GRADE 12, MATHEMATICS AND GENERAL SCHOOL APTITUDE

Pupil Population by Socio-Economic Index	Mathematics Score								
	Northeast			Midwest and West			Southeast		
	Beta	t	N	Beta	t	N	Beta	t	N
Top Quartile	0.171	2.72*	230	0.055	1.18	402	0.100	1.15	165
Second Quartile	0.121	2.22*	304	0.001	0.04	589	-0.019	0.28	195
Third Quartile	0.005	0.11	435	-0.009	0.31	982	0.009	0.22	459
Lowest Quartile	-0.094	0.88	90	-0.008	0.15	306	-0.011	0.21	303
	General School Aptitude								
	Northeast			Midwest and West			Southeast		
	Beta	t	N	Beta	t	N	Beta	t	N
Top Quartile	0.131	2.23*	230	0.021	0.49	402	0.086	1.10	165
Second Quartile	0.129	2.57*	304	0.026	0.76	589	0.007	0.11	195
Third Quartile	-0.015	0.36	435	-0.009	0.36	982	-0.007	0.19	459
Lowest Quartile	-0.023	0.25	90	-0.066	1.35	306	0.004	0.08	303

NOTES: See next page.

Notes, Table 20

Beta Coefficient

A beta coefficient is defined as the relative number of standard deviations of the dependent variable associated with a change of one standard deviation of the independent variable.

Statistical Significance

* = Significant at 95%

** = Significant at 99%

See also the notes to Table 1, page 16.

N

N in this table refers to the number of individual pupils in the applicable categories; the individual unit of observations is the individual pupil and not the high school.

Other Variables in the Multiple Regression Equation

The beta coefficients are net of the effects of pupil intelligence, high school expenditure per pupil, and high school size. See also the detailed discussion of the model on pages 33-43.

TABLE 21

PERFORMANCE IN PROJECT TALENT HIGH SCHOOLS RELATIVE TO EXPENDITURE PER PUPIL BY REGION, GREAT LAKES, PLAINS, SOUTHEAST, FOUR SOCIO-ECONOMIC QUARTILES, GRADE 12, GENERAL TECHNICAL APTITUDE AND MATHEMATICS FACTOR

Pupil Population by Socio-Economic Index	General Technical Aptitude								
	Northeast			Midwest and West			Southeast		
	Beta	t	N	Beta	t	N	Beta	t	N
Top Quartile	0.104	1.83*	230	0.076	1.83*	402	-0.009	0.11	165
Second Quartile	0.013	0.2[illegible]	304	0.013	0.35	589	0.024	0.38	195
Third Quartile	0.047	1.12	435	0.023	0.86	982	-0.052	1.46	459
Lowest Quartile	-0.166	2.18**	90	0.050	1.06	306	-0.042	0.85	303

	Mathematics Factor								
	Northeast			Midwest and West			Southeast		
	Beta	t	N	Beta	t	N	Beta	t	N
Top Quartile	0.215	3.35**	230	0.114	2.36**	402	0.059	0.65	165
Second Quartile	0.056	0.98	304	-0.029	0.65	589	-0.045	0.59	195
Third Quartile	0.035	0.73	435	-0.013	0.42	982	-0.011	0.23	459
Lowest Quartile	-0.120	1.08	90	0.064	1.12	306	-0.015	0.26	303

NOTES: See next page

Notes, Table 21

Beta Coefficient

A beta coefficient is defined as the relative number of standard deviations of the dependent variable associated with a change of one standard deviation of the independent variable.

Statistical Significance

* = Significant at 95%

** = Significant at 99%

See also the notes to Table 1, page 16.

N

N in this table refers to the number of individual pupils in the applicable categories; the individual unit of observations is the individual pupil and not the high school.

Other Variables in the Multiple Regression Equation

The beta coefficients are net of the effects of pupil intelligence, high school expenditure per pupil, and high school size. See also the detailed discussion of the model on pages 33-43.

TABLE 22

PERFORMANCE IN PROJECT TALENT HIGH SCHOOLS RELATIVE TO SIZE IN AVERAGE DAILY ATTENDANCE BY REGION, GREAT LAKES, PLAINS, AND SOUTHEAST, FOUR SOCIO-ECONOMIC QUARTILES, GRADE 12, MATHEMATICS AND GENERAL SCHOOL APTITUDE

Pupil Population by Socio-Economic Index	Mathematics								
	Northeast			Midwest and West			Southeast		
	Beta	t	N	Beta	t	N	Beta	t	N
Top Quartile	0.025	0.39	230	0.093	2.01**	402	-0.029	0.33	165
Second Quartile	-0.018	0.33	304	-0.014	0.38	589	0.072	1.04	195
Third Quartile	-0.023	0.50	435	-0.033	1.11	982	0.156	3.59**	459
Lowest Quartile	0.074	0.71	90	-0.065	1.21	306	0.003	0.05	303

	General School Aptitude								
	Northeast			Midwest and West			Southeast		
	Beta	t	N	Beta	t	N	Beta	t	N
Top Quartile	0.030	0.51	230	0.088	2.09**	402	0.011	0.14	165
Second Quartile	0.008	0.16	304	-0.021	0.60	589	0.089	1.40	195
Third Quartile	0.025	0.62	435	-0.018	0.66	982	0.019	4.78**	459
Lowest Quartile	-0.032	0.34	90	-0.080	1.65*	306	0.017	0.34	303

NOTES: See next page.

Notes, Table 22

Beta Coefficient

A beta coefficient is defined as the relative number of standard deviations of the dependent variable associated with a change of one standard deviation of the independent variable.

Statistical Significance

* = Significant at 95%

** = Significant at 99%

See also the notes to Table 1, page 16.

N

N in this table refers to the number of individual pupils in the applicable categories; the individual unit of observations is the individual pupil and not the high school.

Other Variables in the Multiple Regression Equation

The beta coefficients are net of the effects of pupil intelligence, high school expenditure per pupil, and high school size. See also the detailed discussion of the model on pages 33-43.

Urbanness Characteristics: Individual Pupils as Observations

Tables 23 and 24 contain normalized coefficients of partial regression for expenditure-performance relationships for the four urbanness classifications. Expenditure is positively and significantly related to performance in very few of the populations. The most frequent exceptions to this occur in the urban high schools where the relationship is significant in the top two quartiles for Mathematics, Quartile 3 for General Technical Aptitude, and the top quartile for the Mathematics Factor score. In light of our earlier reasoning that Mathematics scores are good quality measures, it is interesting that the urban high schools do seem to be doing a good job with mathematics for the top two socio-economic quartiles.

The only significantly positive relationship for the Large Cities is in socio-economic group 2 for the Mathematics Factor score. Otherwise, expenditure in the large city high schools seems to have little positive relationship to pupil performance. Indeed, most of the relationships for the bottom two socio-economic quartiles are negative and three of these are statistically significant.

There are too few observations for both the rural and small town high schools to make for meaningful analysis. Especially is this true with the rural districts, although it is interesting that the relationship between General Technical Aptitude and rural expenditure is highly significant in the lowest quartile. It could be that rural schools pay more attention to this type of thing but there are far too few observations here to establish such a conclusion. The village schools seem to do relatively well with their lower socio-economic background pupils, especially with mathematics and technical subjects.

There is no meaningful relationship between size and performance within the urban classifications. The figures in Table 25 could easily have been generated completely by chance.

Summary: Regional and Urbanness Findings Using Individual Pupils as Observations

The information for urban and regional breakdowns given in Tables 20-25 can be summarized into the following points:

1. The relationship between both high school expenditure and size to pupil performance is in general strikingly weak.

2. Pupil performance is more closely related to school expenditure in the urbanness categories than in regions.

3. The almost total lack of relationship between score and expenditure in the regional breakdowns can perhaps be explained by the existence of different combinations of districts in each region according to urbanness characteristics. If the urbanness classifications are meaningful, and if there are different combinations of high schools

TABLE 23

INDIVIDUAL PUPIL PERFORMANCE RELATIVE TO EXPENDITURE PER PUPIL IN PROJECT TALENT HIGH SCHOOLS BY URBAN CLASSIFICATION, FOUR SOCIO-ECONOMIC QUARTILES, GRADE 12, MATHEMATICS AND GENERAL SCHOOL APTITUDE

Pupil Population by Socio-Economic Index	Mathematics Score											
	Urban			Large Cities			Rural			Small Towns		
	Beta	t	N	Beta	t	N	Beta	t	N	Beta	t	N
Top Quartile	0.170	4.52**	620	0.044	0.83	291	N/A	----	----	0.163	1.65*	107
Second Quartile	0.072	2.16**	778	0.082	1.53	341	0.035	0.40	124	0.084	1.27	186
Third Quartile	0.008	0.30	1128	-0.052	1.19	477	N/A	----	----	0.106	2.15**	365
Lowest Quartile	0.039	0.70	318	-0.182	2.30**	138	0.109	1.62*	199	0.041	0.57	182

	General School Aptitude											
	Urban			Large Cities			Rural			Small Towns		
	Beta	t	N	Beta	t	N	Beta	t	N	Beta	t	N
Top Quartile	0.129	3.71**	620	0.039	0.77	291	N/A	----	----	0.102	1.13	107
Second Quartile	0.066	2.15**	778	0.080	1.61*	341	0.034	0.44	124	0.128	2.21**	186
Third Quartile	0.005	0.18	1128	-0.067	1.71*	477	N/A	----	----	0.061	1.38	365
Lowest Quartile	0.083	1.66*	318	-0.074	1.06	138	0.047	0.76	199	-0.051	0.78	182

NOTES: See next page.

Notes, Table 23

Beta Coefficient

A beta coefficient is defined as the relative number of standard deviations of the dependent variable associated with a change of one standard deviation of the independent variable.

Statistical Significance

* = Significant at 95%

** = Significant at 99%

See also the notes to Table 1, page 16.

N

N in this table refers to the number of individual pupils in the applicable categories; the individual unit of observations is the individual pupil and not the high school.

Other Variables in the Multiple Regression Equation

The beta coefficients are net of the effects of pupil intelligence, high school expenditure per pupil, and high school size. See also the detailed discussion of the model on pages 33-43.

TABLE 24

INDIVIDUAL PUPIL PERFORMANCE RELATIVE TO EXPENDITURE PER PUPIL IN PROJECT TALENT HIGH SCHOOLS BY URBAN CLASSIFICATION, FOUR SOCIO-ECONOMIC QUARTILES, GRADE 12, GENERAL TECHNICAL APTITUDE AND MATHEMATICS FACTOR

General Technical Aptitude

Pupil Population by Socio-Economic Index	Urban			Large Cities			Rural			Small Towns		
	Beta	t	N	Beta	t	N	Beta	t	N	Beta	t	N
Top Quartile	0.049	1.43	620	0.029	0.54	291	N/A	----	----	0.101	1.21	107
Second Quartile	0.039	1.28	778	0.022	0.44	341	0.094	1.15	124	0.001	0.02	186
Third Quartile	0.060	2.41**	1128	-0.044	1.13	477	N/A	----	----	0.084	1.93*	365
Lowest Quartile	0.007	0.14	318	-0.148	2.06**	138	0.164	2.70**	199	0.107	1.79*	182

Mathematics Factor

Pupil Population by Socio-Economic Index	Urban			Large Cities			Rural			Small Towns		
	Beta	t	N	Beta	t	N	Beta	t	N	Beta	t	N
Top Quartile	0.167	4.34**	620	0.084	1.47	291	N/A	----	----	0.168	1.67*	107
Second Quartile	0.037	1.05	778	0.108	1.92*	341	0.067	0.72	124	-0.001	0.01	186
Third Quartile	0.012	0.41	1128	0.073	1.54	477	N/A	----	----	0.061	1.13	365
Lowest Quartile	0.076	1.20	318	-0.088	1.00	138	0.106	1.47	199	0.146	1.91*	182

NOTES: See next page.

Notes, Table 24

Beta Coefficient

A beta coefficient is defined as the relative number of standard deviations of the dependent variable associated with a change of one standard deviation of the independent variable.

Statistical Significance

* = Significant at 95%

$\overset{*}{*}$ = Significant at 99%

See also the notes to Table 1, page 16.

N

N in this table refers to the number of individual pupils in the applicable categories; the individual unit of observations is the individual pupil and not the high school.

Other Variables in the Multiple Regression Equation

The beta coefficients are net of the effects of pupil intelligence, high school expenditure per pupil, and high school size. See alsc the detailed discussion of the model on pages 33-43.

TABLE 25

INDIVIDUAL PUPIL PERFORMANCE RELATIVE TO SIZE IN AVERAGE DAILY DAILY ATTENDANCE IN PROJECT TALENT HIGH SCHOOLS BY URBAN CLASSIFICATION, FOUR SOCIO-ECONOMIC QUARTILES, GRADE 12, MATHEMATICS AND GENERAL SCHOOL APTITUDE

Mathematics

Pupil Population by Socio-Economic Index	Urban			Large Cities			Rural			Small Towns		
	Beta	t	N	Beta	t	N	Beta	t	N	Beta	t	N
Top Quartile	0.034	0.91	620	-0.031	0.59	291	N/A	----	----	0.023	0.41	107
Second Quartile	-0.050	1.51	778	-0.022	0.41	341	-0.106	1.23	124	-0.077	1.16	186
Third Quartile	0.054	1.87*	1128	0.056	1.27	477	N/A	----	----	-0.059	1.19	365
Lowest Quartile	0.002	0.05	318	0.045	0.57	138	0.124	1.83*	199	-0.045	0.63	182

General School Aptitude

	Urban			Large Cities			Rural			Small Towns		
	Beta	t	N	Beta	t	N	Beta	t	N	Beta	t	N
Top Quartile	0.039	1.12	620	-0.046	0.92	291	N/A	----	----	0.027	0.29	107
Second Quartile	-0.040	1.33	778	-0.051	1.03	341	-0.114	1.48	124	-0.032	0.56	186
Third Quartile	0.041	1.59	1128	-0.0006	0.02	477	N/A	----	----	-0.072	1.62*	365
Lowest Quartile	-0.007	0.14	318	0.031	0.44	138	0.074	1.20	199	-0.092	1.43	182

NOTES: See next page.

Beta Coefficient

A beta coefficient is defined as the relative number of standard deviations of the dependent variable associated with a change of one standard deviation of the independent variable.

Statistical Significance

* = Significant at 95%

** = Significant at 99%

See also the notes to Table 1, page 16.

N

N in this table refers to the number of individual pupils in the applicable categories; the individual unit of observations is the individual pupil and not the high school.

Other Variables in the Multiple Regression Equation

The beta coefficients are net of the effects of pupil intelligence, high school expenditure per pupil, and high school size. See also the detailed discussion of the model on pages 33-43.

according to such classifications in each region, then conclusions concerning region are not possible. It will be possible to explore this point further in the next section.

4. Generally, pupil performance in the lowest quartiles is less related to school expenditure than in the top quartiles.

5. Pupils in the lowest quartile do not appear to perform better on the Technical Aptitude test in higher spending schools.

Regional and Urban Classifications Cross-Classified: High Schools Used as Observations

Because of limitations of time and cost, the breakdowns just discussed did not include cross-classifications by urbanness and regional categories taken together. This will be undertaken for all pupils in this section. As discussed above, it was decided to collapse the six regions into two regions, Southeast and Northern/Western (for conveniences the latter region will often be referred to below as "North.") This was made feasible because of the relatively heavy representation in the Project Talent sample of the high schools in the Southeast. There are, therefore, represented in Tables 26-39 cross-classifications between two regions and four urbanness characteristics along with all of the applicable marginal totals. These are given for the seven output measures which would have been considered as the most important throughout the study. Tables 26-39 contain a great deal of information and, in fact, can be thought of as summarizing the overall empirical findings for the Project Talent high schools. Because of the problem of the overlapping of the intelligence and achievement performance variables, equations are given in the tables with the Verbal Knowledges Factor score both in and out of the multiple regression equation. As discussed above, the correct expenditure-performance relationships are thought to be somewhere between these two situations. As the reader can see, when expenditure is omitted the computed values for the beta coefficients and values of the t-statistic are greater for the expenditure-performance relationships, although the magnitude of the difference is not large. In discussing the findings in Tables 26-39, it would perhaps be best to discuss each of the seven output measures in turn.

1. English Score

In general, the relationship of high school expenditure to English performance is more positive in grade 9 than in grade 12. In both grades there is very little relationship between expenditure and English score in the eight cross-classification cells when all four variables are entered into the model. In the 9th grade the only significant relationships are found when all districts are taken together and in all Northern districts, the latter being weak. The net relationships in grade 12 are either completely insignificant or significantly negative. Possible reasons for this change from positive to

TABLE 26

CROSS-CLASSIFICATION BY REGION AND URBAN CHARACTERISTICS, BETA COEFFICIENTS, ENGLISH, GRADE 9, ALL PUPILS

Region: North and West

Geographical Setting of the High School	a	E	S	I.Q.	S-E	R^2
Large Cities	-3.73 (7.26)	0.115 (1.52)	0.020 (0.26)		0.801 (11.13)	.620
	-3.72 (7.04)	0.122 (1.66)	0.009 (0.13)	0.270 (2.34)	0.586 (5.08)	.643
	$\bar{x}$ = 73.2		$\bar{s}$ = 11.9		N = 74	
Urban	53.54 (5.20)	0.126 (1.21)	0.064 (0.65)		0.241 (2.05)	.051
	43.08 (4.94)	0.016 (0.15)	0.007 (0.07)	0.421 (3.40)	0.0060 (0.05)	.145
	$\bar{x}$ = 77.5		$\bar{s}$ = 5.4		N = 100	
Small Town	13.41 (6.19)	0.087 (1.42)	-0.137 (2.27)		0.728 (11.91)	.548
	12.53 (5.79)	0.061 (1.06)	-0.110 (1.94)	0.387 (4.35)	0.432 (4.85)	.605
	$\bar{x}$ = 76.2		$\bar{s}$ = 9.2		N = 127	
Rural	18.78 (8.60)	0.107 (1.48)	-0.013 (0.18)		0.598 (8.28)	.355
	14.51 (8.40)	0.075 (1.05)	-0.016 (0.23)	0.250 (2.63)	0.435 (4.63)	.385
	$\bar{x}$ = 75.3		$\bar{s}$ = 10.8		N = 124	
Totals	15.69 (7.09)	0.088 (2.42)	-0.108 (2.96)		.665 (18.45)	.454
	14.26 (6.80)	0.067 (1.89)	-0.126 (3.36)	0.328 (6.10)	0.431 (8.35)	.498
	$\bar{x}$ = 75.7		$\bar{s}$ = 9.6		N = 425	

Region: Southeast

Geographical Setting of the High School	a	E	S	I.Q.	S-E	R^2
Large Cities	(Not possible to compute)					
	$\bar{x}$ = 69.7		$\bar{s}$ = 5.4		N = 4	
Urban	-25.26 (9.04)	0.119 (0.98)	0.094 (0.72)		0.545 (4.28)	.328
	-27.03 (8.02)	0.175 (1.61)	0.024 (0.21)	0.515 (3.64)	0.222 (1.55)	.472
	$\bar{x}$ = 70.7		$\bar{s}$ = 11.1		N = 49	
Small Town	-17.84 (9.37)	-0.044 (0.28)	0.118 (0.75)		0.587 (3.64)	.244
	-17.87 (9.24)	-0.050 (0.32)	0.079 (0.50)	0.247 (1.33)	0.440 (2.27)	.264
	$\bar{x}$ = 70.8		$\bar{s}$ = 11.0		N = 32	
Rural	0.13 (9.65)	0.069 (1.04)	-0.046 (0.68)		0.833 (12.40)	.662
	-1.33 (9.19)	0.067 (1.06)	-0.040 (0.63)	0.400 (2.92)	0.477 (3.46)	.694
	$\bar{x}$ = 66.7		$\bar{s}$ = 16.7		N = 77	
Totals	-0.39 (9.35)	0.044 (0.82)	-0.005 (0.10)		0.753 (13.94)	.556
	-1.93 (8.82)	0.047 (0.93)	-0.035 (0.66)	0.423 (4.54)	0.402 (4.35)	.605
	$\bar{x}$ = 68.9		$\bar{s}$ = 14.1		N = 162	

Region: Total

Geographical Setting of the High School	a	E	S	I.Q.	S-E	R^2
Large Cities	-1.45 (7.25)	0.098 (1.27)	0.021 (0.28)		0.796 (11.22)	.611
	-0.86 (7.01)	0.098 (1.32)	0.009 (0.13)	0.278 (2.47)	0.573 (5.06)	.636
	$\bar{x}$ = 73.2		$\bar{s}$ = 11.7		N = 78	
Urban	14.53 (7.08)	0.128 (1.63)	0.105 (1.46)		0.437 (5.48)	.277
	7.38 (6.46)	0.050 (0.69)	0.495 (0.67)	0.493 (5.47)	0.150 (1.67)	.397
	$\bar{x}$ = 75.2		$\bar{s}$ = 8.4		N = 149	
Small Town	9.09 (6.99)	0.138 (2.37)	-0.088 (1.54)		0.667 (11.57)	.490
	8.44 (6.59)	0.097 (1.74)	-0.078 (1.45)	0.369 (4.53)	0.399 (4.96)	.547
	$\bar{x}$ = 75.1		$\bar{s}$ = 9.8		N = 159	
Rural	7.11 (9.03)	0.110 (2.34)	-0.021 (0.46)		0.738 (15.79)	.579
	4.49 (8.68)	0.085 (1.86)	-0.023 (0.51)	0.316 (4.14)	0.486 (6.43)	.611
	$\bar{x}$ = 72.0		$\bar{s}$ = 14.0		N = 201	
Totals	5.57 (7.81)	0.124 (4.18)	-0.074 (2.52)		0.705 (24.47)	.530
	6.41 (7.44)	0.099 (3.49)	-0.093 (3.33)	0.346 (7.71)	0.437 (9.87)	.573
	$\bar{x}$ = 73.8		$\bar{s}$ = 11.4		N = 587	

Notes: Notes for Tables 26-39 appear after Table 39, page 127.

TABLE 27

CROSS-CLASSIFICATION BY REGION AND URBAN CHARACTERISTICS, BETA COEFFICIENTS
MATHEMATICS, GRADE 9, ALL PUPILS

Region: North and West

Geographical Setting of the High School	a	E	S	I. Q.	S-E	R^2
Large Cities	1.52 (3.77)	-0.096 (0.89)	0.016 (0.16)		0.501 (4.88)	.225
	1.52 (3.50)	-0.083 (0.82)	-0.0042 (0.04)	0.552 (3.50)	0.062 (0.39)	.333
	$\bar{x}$ = 14.5		$\bar{s}$ = 4.3	N = 74		
Urban	-0.52 (2.75)	0.248 (2.53)	-0.034 (0.36)		0.280 (2.84)	.152
	-5.26 (2.66)	0.159 (1.60)	-0.080 (0.87)	0.342 (2.87)	0.112 (1.00)	.212
	$\bar{x}$ = 17.3		$\bar{s}$ = 3.0	N = 100		
Small Town	-6.47 (3.37)	0.242 (3.38)	-0.115 (1.63)		0.537 (7.50)	.380
	-7.05 (3.03)	0.204 (3.16)	-0.077 (1.21)	0.552 (5.51)	0.114 (1.14)	.500
	$\bar{x}$ = 17.2		$\bar{s}$ = 4.3	N = 127		
Rural	-0.58 (3.97)	0.096 (1.17)	-0.017 (0.20)		0.441 (5.42)	.182
	-1.75 (3.95)	0.074 (0.90)	-0.019 (0.23)	0.168 (1.54)	0.332 (3.08)	.191
	$\bar{x}$ = 16.7		$\bar{s}$ = 4.4	N = 124		
Totals	-2.53 (3.54)	0.141 (3.35)	-0.226 (5.39)		0.473 (11.42)	.277
	-3.28 (3.38)	0.115 (2.85)	-0.250 (6.20)	0.383 (6.42)	0.192 (3.24)	.340
	$\bar{x}$ = 16.6		$\bar{s}$ = 4.2	N = 425		

Region: Southeast

Geographical Setting of the High School	a	E	S	I. Q.	S-E	R^2
Large Cities	(Not possible to compute.)					
	$\bar{x}$ = 13.9		$\bar{s}$ = 3.8	N = 4		
Urban	-27.08 (2.74)	0.111 (1.06)	0.051 (0.45)		0.687 (6.24)	.497
	-27.68 (2.33)	0.165 (1.83)	-0.016 (0.17)	0.499 (4.24)	0.374 (3.14)	.635
	$\bar{x}$ = 14.3		$\bar{s}$ = 3.9	N = 49		
Small Town	-18.42 (3.30)	-0.008 (0.05)	0.030 (0.19)		0.599 (3.75)	.260
	-18.44 (3.12)	-0.017 (0.12)	-0.028 (0.18)	0.365 (2.09)	0.381 (2.07)	.339
	$\bar{x}$ = 13.6		$\bar{s}$ = 3.9	N = 32		
Rural	-0.16 (3.53)	0.045 (0.48)	-0.027 (0.28)		0.603 (6.35)	.322
	0.91 (3.15)	0.040 (0.48)	-0.016 (0.19)	0.800 (4.38)	-0.109 (0.60)	.458
	$\bar{x}$ = 12.3		$\bar{s}$ = 4.3	N = 77		
Totals	-2.80 (3.36)	0.042 (0.64)	0.082 (1.22)		0.571 (8.68)	.342
	-3.52 (3.03)	0.047 (0.80)	0.036 (0.59)	0.663 (6.12)	0.021 (0.20)	.465
	$\bar{x}$ = 13.2		$\bar{s}$ = 4.2	N = 162		

Region: Total

Geographical Setting of the High School	a	E	S	I. Q.	S-E	R^2
Large Cities	0.23 (3.74)	-0.072 (0.66)	0.027 (0.25)		0.501 (4.99)	.222
	0.67 (3.45)	-0.071 (0.70)	0.003 (0.03)	0.573 (3.75)	0.045 (0.29)	.339
	$\bar{x}$ = 14.4		$\bar{s}$ = 4.3	N = 78		
Urban	-13.44 (2.84)	0.215 (2.96)	0.023 (0.35)		0.493 (6.66)	.376
	-16.18 (2.61)	0.146 (2.14)	-0.030 (0.48)	0.438 (5.17)	0.239 (2.83)	.470
	$\bar{x}$ = 16.3		$\bar{s}$ = 3.6	N = 149		
Small Town	-8.53 (3.39)	0.311 (5.02)	-0.099 (1.62)		0.514 (8.33)	.417
	-8.93 (3.06)	0.256 (4.50)	-0.086 (1.56)	0.500 (5.99)	0.150 (1.82)	.524
	$\bar{x}$ = 16.5		$\bar{s}$ = 4.5	N = 159		
Rural	-2.31 (3.87)	0.244 (4.22)	-0.019 (0.33)		0.515 (8.94)	.361
	-3.20 (3.78)	0.220 (3.85)	-0.020 (0.36)	0.308 (3.22)	0.269 (2.84)	.390
	$\bar{x}$ = 15.0		$\bar{s}$ = 4.9	N = 201		
Totals	-4.51 (3.55)	0.250 (7.24)	-0.171 (5.00)		0.516 (15.35)	.361
	-5.09 (3.35)	0.219 (6.67)	-0.196 (6.05)	0.441 (8.50)	0.175 (3.41)	.430
	$\bar{x}$ = 15.7		$\bar{s}$ = 4.4	N = 587		

Notes: Notes for Tables 26-39 appear after Table 39, page 127.

TABLE 28

CROSS-CLASSIFICATION BY REGION AND URBAN CHARACTERISTICS, BETA COEFFICIENTS, GENERAL SCHOOL APTITUDE, GRADE 9, ALL PUPILS

Geographical Setting of the High School	Region: North and West a	E	S	I. Q.	S-E	R^2	Southeast a	E	S	I. Q.	S-E	R^2	Total a	E	S	I. Q.	S-E	R^2
Large Cities	-36.88 (59.86)	0.035 (0.40)	-0.009 (0.10)		0.723 (8.68)	.491	(Not possible to compute.)						-42.61 (59.80)	0.041 (0.47)	0.001 (0.01)		0.717 (8.78)	.484
	-36.784 (53.16)	0.049 (0.62)	-0.030 (0.38)	0.544 (4.45)	0.289 (2.37)	.599							-34.166 (52.81)	0.043 (0.55)	-0.024 (0.30)	0.557 (4.68)	0.274 (2.30)	.598
	$\bar{x}$ = 416.1		$\bar{s}$ = 84.5		N = 74		$\bar{x}$ = 405.7		$\bar{s}$ = 79.8		N = 4		$\bar{x}$ = 415.6		$\bar{s}$ = 83.8		N = 78	
Urban	181.80 (44.15)	0.191 (1.91)	0.005 (0.05)		0.287 (2.86)	.123	-455.68 (60.46)	0.128 (1.19)	0.081 (0.70)		0.650 (5.76)	.471	-137.49 (53.58)	0.177 (2.45)	0.070 (1.04)		0.509 (6.91)	.382
	61.01 (39.67)	0.047 (0.50)	-0.069 (0.80)	0.552 (4.89)	0.014 (0.13)	.292	-470.62 (48.46)	0.191 (2.19)	0.003 (0.03)	0.579 (5.10)	0.287 (2.50)	.660	-205.27 (45.95)	0.089 (1.39)	-0.001 (0.01)	0.571 (7.29)	0.176 (2.26)	.545
	$\bar{x}$ = 462.1		$\bar{s}$ = 47.4		N = 100		$\bar{x}$ = 399.0		$\bar{s}$ = 84.0		N = 49		$\bar{x}$ = 441.4		$\bar{s}$ = 68.4		N = 149	
Small Town	-27.05 (50.73)	0.191 (3.01)	-0.100 (1.58)		0.664 (10.42)	.508	-375.03 (68.82)	-0.031 (0.21)	0.090 (0.60)		0.651 (4.29)	.330	-76.70 (56.06)	0.251 (4.33)	-0.075 (1.32)		0.617 (10.71)	.492
	-37.90 (42.38)	0.150 (2.81)	-0.057 (1.08)	0.611 (7.37)	0.195 (2.35)	.657	-375.52 (62.10)	-0.043 (0.32)	0.022 (0.16)	0.434 (2.72)	0.392 (2.35)	.454	-84.65 (47.89)	0.188 (3.75)	-0.061 (1.25)	0.563 (7.64)	0.207 (2.85)	.629
	$\bar{x}$ = 449.9		$\bar{s}$ = 72.6		N = 127		$\bar{x}$ = 389.8		$\bar{s}$ = 85.4		N = 32		$\bar{x}$ = 437.8		$\bar{s}$ = 78.9		N = 159	
Rural	39.10 (64.56)	0.156 (2.12)	-0.026 (0.36)		0.564 (7.66)	.331	[illegible]	0.053 (0.68)	-0.055 (0.70)		0.754 (9.53)	.531	-10.93 (66.48)	0.220 (4.42)	-0.032 (0.66)		0.657 (13.25)	.527
	-7.28 (60.99)	0.109 (1.54)	-0.031 (0.44)	0.368 (3.93)	0.324 (3.50)	.403	-19.08 (59.33)	0.048 (0.72)	-0.045 (0.67)	0.763 (5.25)	0.074 (0.51)	.656	-38.18 (61.06)	0.182 (3.95)	-0.034 (0.76)	0.474 (6.13)	0.279 (3.64)	.601
	$\bar{x}$ = 442.2		$\bar{s}$ = 79.2		N = 124		$\bar{x}$ = 360.7		$\bar{s}$ = 101.9		N = 77		$\bar{x}$ = 411.0		$\bar{s}$ = 96.9		N = 201	
Totals	9.00 (55.78)	0.135 (3.58)	-0.172 (4.58)		0.620 (16.69)	.420	-44.64 (68.09)	0.040 (0.68)	0.055 (0.91)		0.680 (11.55)	.473	-41.51 (60.00)	0.215 (7.00)	-0.116 (3.84)		0.646 (21.67)	.496
	-8.32 (50.18)	0.101 (2.95)	-0.203 (5.98)	0.503 (9.99)	0.250 (5.02)	.531	-61.43 (58.81)	0.046 (0.91)	0.008 (0.14)	0.688 (7.40)	0.110 (1.19)	.607	-54.91 (53.41)	0.176 (6.42)	-0.147 (5.43)	0.539 (12.42)	0.229 (5.36)	.601
	$\bar{x}$ = 444.6		$\bar{s}$ = 73.3		N = 425		$\bar{x}$ = 379.1		$\bar{s}$ = 94.1		N = 162		$\bar{x}$ = 426.6		$\bar{s}$ = 84.6		N = 587	

Notes: Notes for Tables 26-39 appear after Table 39, page 127.

TABLE 29

CROSS-CLASSIFICATION BY REGION AND URBAN CHARACTERISTICS, BETA COEFFICIENTS, GENERAL TECHNICAL APTITUDE, GRADE 9, ALL PUPILS

Geographical Setting of the High School	Region: North and West						Southeast						Total					
	a	E	S	I. Q.	S-E	R^2	a	E	S	I. Q.	S-E	R^2	a	E	S	I. Q.	S-E	R^2
Large Cities	13.03	-0.081	0.034		0.547	.273	(Not possible to compute.)						-13.13	-0.005	-0.094		0.626	.369
	(8.15)	(0.77)	(0.33)		(5.49)								(8.63)	(0.05)	(0.96)		(6.93)	
	-11.485	0.003	-0.131	0.701	0.068	.552							-11.730	-0.003	-0.124	0.707	0.364	.555
	(7.38)	(0.04)	(1.59)	(5.41)	(0.53)								(7.25)	(0.03)	(1.51)	(5.65)	(0.51)	
	$\bar{x}$ = 34.8		$\bar{s}$ = 11.1		N = 74		$\bar{x}$ = 35.0		$\bar{s}$ = 8.7		N = 4		$\bar{x}$ = 34.8		$\bar{s}$ = 10.9		N = 78	
Urban	-6.83	0.057	-0.199		0.465	.220	-66.25	0.130	0.068		0.690	.525	-39.87	0.122	-0.047		0.621	.439
	(5.25)	(0.60)	(2.23)		(4.91)		(6.48)	(1.28)	(0.62)		(6.45)		(6.12)	(1.77)	(0.74)		(8.86)	
	-15.28	-0.023	-0.240	0.306	0.314	.267	-68.01	0.196	-0.014	0.604	0.312	.733	-46.42	0.050	-0.103	0.461	0.353	.544
	(5.09)	(0.24)	(2.73)	(2.67)	(2.90)		(4.86)	(2.54)	(0.16)	(6.02)	(3.06)		(5.52)	(0.78)	(1.77)	(5.87)	(4.53)	
	$\bar{x}$ = 43.9		$\bar{s}$ = 6.0		N = 100		$\bar{x}$ = 35.9		$\bar{s}$ = 9.5		N = 49		$\bar{x}$ = 41.3		$\bar{s}$ = 8.2		N = 149	
Small Town	-9.44	0.284	-0.152		0.498	.376	-43.67	-0.050	0.018		0.504	.157	-15.91	0.354	-0.126		0.457	.398
	(8.01)	(3.96)	(2.14)		(6.93)		(10.25)	(0.30)	(0.11)		(2.96)		(8.67)	(5.62)	(2.03)		(7.29)	
	-10.98	0.243	-0.109	0.617	0.024	.527	-43.79	-0.070	-0.102	0.767	0.046	.592	-17.20	0.282	-0.109	0.643	-0.011	.578
	(6.98)	(3.86)	(1.75)	(6.33)	(0.25)		(7.13)	(0.61)	(0.86)	(5.55)	(0.32)		(7.26)	(5.28)	(2.10)	(8.18)	(0.15)	
	$\bar{x}$ = 43.6		$\bar{s}$ = 10.2		N = 127		$\bar{x}$ = 33.1		$\bar{s}$ = 11.4		N = 32		$\bar{x}$ = 41.4		$\bar{s}$ = 11.2		N = 159	
Rural	0.97	0.119	0.007		0.435	.182	-0.12	0.069	-0.096		0.624	.346	-2.46	0.213	-0.013		0.527	.354
	(9.21)	(1.46)	(0.08)		(5.34)		(8.79)	(0.75)	(0.60)		(6.68)		(9.05)	(3.66)	(0.23)		(9.10)	
	-10.44	0.029	-0.002	0.703	-0.024	.458	-2.68	0.062	-0.042	1.066	-0.325	.593	-7.81	0.149	-0.016	0.797	-0.109	.567
	(7.50)	(0.43)	(0.04)	(7.87)	(0.27)		(6.93)	(0.85)	(0.57)	(6.74)	(2.05)		(7.41)	(3.11)	(0.35)	(9.91)	(1.36)	
	$\bar{x}$ = 41.3		$\bar{s}$ = 10.2		N = 124		$\bar{x}$ = 32.6		$\bar{s}$ = 10.9		N = 77		$\bar{x}$ = 38.0		$\bar{s}$ = 11.3		N = 201	
Totals	-6.40	0.125	-0.308		0.503	.338	-5.24	0.038	0.064		0.552	.311	-10.13	0.227	-0.236		0.536	.381
	(8.18)	(3.11)	(7.67)		(12.67)		(8.75)	(0.57)	(0.93)		(8.20)		(8.45)	(6.69)	(7.02)		(16.19)	
	-9.37	0.082	-0.347	0.628	0.041	.511	-7.86	0.046	-0.002	0.955	-0.240	.571	-12.35	0.177	-0.276	0.700	-0.006	.558
	(7.03)	(2.37)	(10.01)	(12.22)	(0.80)		(6.90)	(0.87)	(0.03)	(9.84)	(2.49)		(7.14)	(6.13)	(9.67)	(15.33)	(0.14)	
	$\bar{x}$ = 41.4		$\bar{s}$ = 10.1		N = 425		$\bar{x}$ = 33.8		$\bar{s}$ = 10.6		N = 162		$\bar{x}$ = 39.3		$\bar{s}$ = 10.8		N = 587	

Notes: Notes for Tables 26-39 appear after Table 39, page 127.

TABLE 30

CROSS-CLASSIFICATION BY REGION AND URBAN CHARACTERISTICS, BETA COEFFICIENTS, ENGLISH FACTOR, GRADE 9, ALL PUPILS

Region: North and West

Geographical Setting of the High School	a	E	S	I. Q.	S-E	R^2
Large Cities	6.29 (9.15)	0.144 (1.29)	-0.003 (0.03)		0.469 (4.45)	.185
	6.284 (8.99)	0.136 (1.24)	0.0096 (0.09)	-0.323 (1.88)	0.726 (4.24)	.214
	$\bar{x}$ = 49.6		$\bar{s}$ = 10.2		N = 74	
Urban	79.31 (5.56)	0.075 (0.72)	0.056 (0.57)		-0.291 (2.76)	.036
	76.12 (5.57)	0.043 (0.39)	0.040 (0.40)	0.121 (0.92)	-0.351 (2.83)	.035
	$\bar{x}$ = 50.4		$\bar{s}$ = 5.7		N = 100	
Small Town	19.04 (6.71)	-0.112 (1.39)	-0.047 (0.59)		0.497 (6.15)	.211
	19.01 (6.74)	-0.113 (1.39)	-0.046 (0.58)	0.015 (0.12)	0.485 (3.84)	.204
	$\bar{x}$ = 51.0		$\bar{s}$ = 7.6		N = 127	
Rural	16.06 (9.75)	0.095 (1.12)	-0.011 (0.13)		0.376 (4.46)	.126
	17.07 (9.78)	0.103 (1.19)	-0.009 (0.12)	-0.060 (0.53)	0.415 (3.69)	.120
	$\bar{x}$ = 51.3		$\bar{s}$ = 10.5		N = 124	
Totals	22.24 (8.11)	0.029 (0.63)	-0.061 (1.32)		0.356 (7.78)	.122
	22.61 (8.10)	0.035 (0.76)	-0.055 (1.19)	-0.091 (1.32)	0.423 (6.20)	.123
	$\bar{x}$ = 50.7		$\bar{s}$ = 8.7		N = 425	

Region: Southwest

Geographical Setting of the High School	a	E	S	I. Q.	S-E	R^2
Large Cities	(Not possible to compute)					
	$\bar{x}$ = 51.5		$\bar{s}$ = 4.7		N = 4	
Urban	12.01 (6.62)	0.211 (1.50)	0.071 (0.47)		0.286 (1.94)	.098
	11.70 (6.64)	0.226 (1.59)	0.051 (0.33)	0.145 (0.78)	0.195 (1.04)	.090
	$\bar{x}$ = 48.5		$\bar{s}$ = 7.0		N = 49	
Small Town	6.02 (7.38)	-0.147 (0.86)	0.186 (1.09)		0.419 (2.39)	.106
	6.05 (7.22)	-0.139 (0.83)	0.233 (1.36)	-0.301 (1.50)	0.598 (2.86)	.144
	$\bar{x}$ = 50.1		$\bar{s}$ = 7.9		N = 32	
Rural	3.36 (7.86)	0.021 (0.28)	-0.043 (0.57)		0.777 (10.26)	.571
	3.15 (7.50)	0.021 (0.28)	-0.042 (0.55)	0.081 (0.50)	0.704 (4.29)	.566
	$\bar{x}$ = 46.9		$\bar{s}$ = 12.1		N = 77	
Totals	5.03 (7.36)	0.011 (0.18)	-0.040 (0.64)		0.685 (11.32)	.443
	5.05 (7.38)	0.011 (0.18)	-0.039 (0.62)	-0.008 (0.07)	0.691 (6.28)	.440
	$\bar{x}$ = 48.1		$\bar{s}$ = 9.9		N = 162	

Region: Total

Geographical Setting of the High School	a	E	S	I. Q.	S-E	R^2
Large Cities	10.22 (9.00)	0.104 (0.93)	-0.007 (0.06)		0.467 (4.53)	.178
	9.644 (8.84)	0.103 (0.94)	0.007 (0.06)	-0.320 (1.91)	0.721 (4.31)	.206
	$\bar{x}$ = 49.7		$\bar{s}$ = 10.0		N = 78	
Urban	48.91 (6.20)	0.101 (1.10)	0.108 (1.27)		-0.018 (0.19)	.000
	46.99 (6.17)	0.074 (0.79)	0.086 (1.00)	0.178 (1.54)	-0.122 (1.06)	.006
	$\bar{x}$ = 49.8		$\bar{s}$ = 6.2		N = 149	
Small Town	17.05 (6.82)	-0.093 (1.28)	-0.004 (0.05)		0.474 (6.56)	.197
	17.11 (6.84)	-0.088 (1.19)	-0.005 (0.07)	-0.047 (0.43)	0.508 (4.74)	.193
	$\bar{x}$ = 50.8		$\bar{s}$ = 7.6		N = 159	
Rural	8.33 (9.07)	0.060 (1.03)	-0.019 (0.33)		0.590 (10.16)	.351
	8.26 (9.09)	0.059 (1.01)	-0.019 (0.33)	0.011 (0.11)	0.581 (5.93)	.348
	$\bar{x}$ = 49.6		$\bar{s}$ = 11.3		N = 201	
Totals	14.95 (7.94)	0.031 (0.82)	-0.051 (1.37)		0.484 (13.14)	.232
	15.12 (7.94)	0.036 (0.93)	-0.048 (1.27)	-0.064 (1.07)	0.534 (8.99)	.232
	$\bar{x}$ = 50.0		$\bar{s}$ = 9.1		N = 587	

Notes: Notes for Tables 26-39 appear after Table 39, page 127.

TABLE 31

CROSS-CLASSIFICATION BY REGION AND URBAN CHARACTERISTICS, BETA COEFFICIENTS, MATHEMATICS FACTOR, GRADE 9, ALL PUPILS

Geographical Setting of the High School	Region: North and West						Southwest						Total					
	a	E	S	I. Q.	S-E	R^2	a	E	S	I. Q.	S-E	R^2	a	E	S	I. Q.	S-E	R^2
Large Cities	18.80	-0.128	0.122		0.583	.339	(Not possible to compute)						17.83	-0.123	0.119		0.580	.333
	(6.56)	(1.28)	(1.23)		(6.14)								(6.43)	(1.22)	(1.19)		(6.25)	
	18.802	-0.129	0.124	-0.053	0.626	.330							17.745	-0.123	0.122	-0.058	0.627	.325
	(6.60)	(1.28)	(1.24)	(0.34)	(3.96)								(6.46)	(1.22)	(1.20)	(0.38)	(4.06)	
	$\bar{x}$ = 48.0		$\bar{s}$ = 8.1	N = 74			$\bar{x}$ = 48.8		$\bar{s}$ = 1.6	N = 4			$\bar{x}$ = 48.0		$\bar{s}$ = 7.9	N = 78		
Urban	32.58	0.092	-0.163		0.259	.068	55.82	-0.239	-0.212		-0.032	.060	43.51	0.020	-0.214		0.142	.025
	(3.47)	(0.89)	(1.67)		(2.50)		(2.91)	(1.67)	(1.38)		(0.21)		(3.37)	(0.22)	(2.55)		(1.54)	
	32.99	0.098	-0.159	-0.024	0.271	.058	55.91	-0.250	-0.199	-0.098	0.029	.044	43.90	0.030	-0.206	-0.065	0.180	.021
	(3.49)	(0.90)	(1.60)	(0.19)	(2.22)		(2.93)	(1.71)	(1.26)	(0.51)	(0.15)		(3.38)	(0.33)	(2.41)	(0.57)	(1.57)	
	$\bar{x}$ = 51.0		$\bar{s}$ = 6.9	N = 127			$\bar{x}$ = 50.4		$\bar{s}$ = 5.1	N = 32			$\bar{x}$ = 50.9		$\bar{s}$ = 6.5	N = 159		
Small Town	11.89	0.179	-0.194		0.592	.423	87.04	-0.064	-0.256		0.477	.119	19.73	0.152	-0.150		0.474	.278
	(5.19)	(2.59)	(2.84)		(8.58)		(4.74)	(0.37)	(1.50)		(2.74)		(5.54)	(2.21)	(2.21)		(6.91)	
	11.78	0.174	-0.189	0.063	0.544	.420	87.03	-0.069	-0.286	0.194	-0.592	.116	19.62	0.142	-0.148	0.094	0.406	.276
	(5.20)	(2.51)	(2.75)	(0.59)	(5.04)		(4.74)	(0.40)	(1.64)	(0.95)	(2.79)		(5.54)	(2.03)	(2.17)	(0.91)	(4.00)	
	$\bar{x}$ = 49.9		$\bar{s}$ = 7.5	N = 124			$\bar{x}$ = 48.0		$\bar{s}$ = 10.5	N = 77			$\bar{x}$ = 50.9		$\bar{s}$ = 6.5	N = 159		
Rural	22.98	-0.153	0.061		0.475	.224	6.97	-0.020	-0.038		0.859	.719	13.24	-0.148	0.024		0.719	.490
	(6.55)	(1.92)	(0.77)		(6.00)		(5.54)	(0.33)	(0.63)		(14.04)		(6.26)	(2.86)	(0.48)		(13.96)	
	22.58	-0.157	0.060	0.034	0.453	.218	6.66	-0.021	-0.036	0.137	0.738	.720	12.67	-0.157	0.024	0.108	0.632	.491
	(6.58)	(1.94)	(0.76)	(0.32)	(4.28)		(5.54)	(0.35)	(0.60)	(1.04)	(5.59)		(6.26)	(3.01)	(0.47)	(1.24)	(7.31)	
	$\bar{x}$ = 49.9		$\bar{s}$ = 7.5	N = 124			$\bar{x}$ = 48.0		$\bar{s}$ = 10.5	N = 77			$\bar{x}$ = 49.2		$\bar{s}$ = 8.8	N = 201		
Totals	18.51	0.012	-0.119		0.515	.268	13.48	-0.032	-0.152		0.753	.527	17.50	-0.047	-0.116		0.600	.349
	(5.77)	(0.29)	(2.82)		(12.35)		(5.39)	(0.58)	(2.67)		(13.50)		(5.70)	(1.34)	(3.38)		(17.71)	
	18.43	0.010	-0.121	0.026	0.500	.266	13.28	-0.031	-0.159	0.099	0.670	.526	17.41	-0.050	-0.119	0.040	0.569	.349
	(5.78)	(0.24)	(2.85)	(0.40)	(7.96)		(5.39)	(0.56)	(2.77)	(0.98)	(6.62)		(5.70)	(1.41)	(3.43)	(0.73)	(10.41)	
	$\bar{x}$ = 49.9		$\bar{s}$ = 6.8	N = 425			$\bar{x}$ = 49.2		$\bar{s}$ = 7.9	N = 162			$\bar{x}$ = 49.8		$\bar{s}$ = 7.1	N = 587		

Notes: Notes for Tables 26-39 appear after Table 39, page 127.

TABLE 32

CROSS-CLASSIFICATION BY REGION AND URBAN CHARACTERISTICS, BETA COEFFICIENTS, CURRICULUM MEASURE, GRADE 9, ALL PUPILS

Geographical Setting of the High School	Region: North and West						Southeast						Total					
	a	E	S	I. Q.	S-E	R^2	a	E	S	I. Q.	S-E	R^2	a	E	S	I. Q.	S-E	R^2
Large Cities	27.64	0.029	0.615		0.195	.395	(Not possible to compute)						39.79	-0.028	0.589		0.178	.334
	(17.51)	(0.30)	(6.45)		(2.15)								(18.22)	(0.28	(5.86)		(1.91)	
	27.643	0.029	0.614	0.020	0.179	.386							39.79	-0.028	0.589	0.002	0.177	.325
	(17.63)	(0.30)	(6.38)	(0.13)	(1.19)								(18.34)	(0.27)	(5.81)	(0.01)	(1.14)	
	$\bar{x}$ = 90.7		$\bar{s}$ = 22.7		N = 74		$\bar{x}$ = 88.8		$\bar{s}$ = 21.0		N = 4		$\bar{x}$ = 90.6		$\bar{s}$ = 22.5		N = 78	
Urban	68.67	0.149	0.473		-0.052	.218	2.96	0.208	0.204		0.132	.078	30.05	0.270	0.397		0.031	.263
	(18.75)	(1.57)	(5.30)		(0.55)		(16.41)	(1.47)	(1.34)		(0.89)		(18.48)	(3.43)	(5.44)		(0.39)	
	50.08	0.099	0.448	0.189	-0.145	.231	4.48	0.177	0.244	-0.286	0.312	.107	29.31	0.267	0.395	0.020	0.020	.258
	(18.59)	(1.01)	(4.98)	(1.61)	(1.31)		(16.16)	(1.26)	(1.60)	(1.56)	(1.67)		(18.54)	(3.31)	(5.31)	(0.20)	(0.20)	
	$\bar{x}$ = 73.6		$\bar{s}$ = 21.3		N = 100		$\bar{x}$ = 56.4		$\bar{s}$ = 17.3		N = 49		$\bar{x}$ = 68.0		$\bar{s}$ = 21.6		N = 149	
Small Town	27.38	0.054	0.578		0.056	.321	21.65	0.200	0.171		0.067	.000	23.28	0.136	0.482		0.074	.228
	(13.36)	(0.72)	(7.82)		(0.75)		(15.19)	(1.07)	(0.91)		(0.35)		(14.10)	(1.91)	(6.87)		(1.05)	
	27.89	0.063	0.569	-0.128	0.154	.322	21.62	0.196	0.150	0.128	-0.010	.000	23.55	0.146	0.480	-0.093	0.142	.227
	(13.35)	(0.84)	(7.66)	(1.10)	(1.32)		(15.38)	(1.04)	(0.78)	(0.57)	(0.04)		(14.11)	(2.02)	(6.82)	(0.88)	(1.35)	
	$\bar{x}$ = 54.4		$\bar{s}$ = 16.3		N = 127		$\bar{x}$ = 49.2		$\bar{s}$ = 14.9		N = 32		$\bar{x}$ = 53.3		$\bar{s}$ = 16.1		N = 159	
Rural	22.47	0.069	0.494		0.114	.233	39.62	-0.076	0.481		-0.046	.195	26.58	0.163	0.479		0.076	.239
	(14.64)	(0.87)	(6.24)		(1.45)		(11.85)	(0.74)	(4.65)		(0.44)		(13.76)	(2.58)	(7.72)		(1.21)	
	25.73	0.085	0.500	-0.122	0.194	.235	39.92	-0.075	0.480	-0.102	0.045	.186	28.02	0.175	0.479	-0.154	0.199	.243
	(14.62)	(1.05)	(6.27)	(1.15)	(1.85)		(11.92)	(0.73)	(4.61)	(0.56)	(0.20)		(13.72)	(2.76)	(7.75)	(1.44)	(1.88)	
	$\bar{x}$ = 49.9		$\bar{s}$ = 16.8		N = 124		$\bar{x}$ = 43.5		$\bar{s}$ = 13.3		N = 77		$\bar{x}$ = 47.4		$\bar{s}$ = 15.8		N = 201	
Totals	22.57	-0.013	0.677		0.138	.477	30.84	0.095	0.391		0.067	.174	21.48	0.074	0.629		0.131	.459
	(17.59)	(0.36)	(18.94)		(3.90)		(15.52)	(1.31)	(5.20)		(0.91)		(17.21)	(2.34)	(20.03)		(4.24)	
	22.27	-0.015	0.675	0.027	0.118	.476	31.42	0.094	0.400	-0.130	0.175	.174	21.49	0.074	0.629	-0.001	0.132	.458
	(17.61)	(0.41)	(18.80)	(0.50)	(2.24)		(15.53)	(1.29)	(5.27)	(0.97)	(1.51)		(17.22)	(2.33)	(19.93)	(0.01)	(2.64)	
	$\bar{x}$ = 63.9		$\bar{s}$ = 24.4		N = 425		$\bar{x}$ = 49.6		$\bar{s}$ = 17.1		N = 162		$\bar{x}$ = 59.9		$\bar{s}$ = 23.4		N = 587	

Notes: Notes for Tables 26-39 appear after Table 39, page 127.

TABLE 33

CROSS-CLASSIFICATION BY REGION AND URBAN CHARACTERISTICS, BETA COEFFICIENTS, ENGLISH, GRADE 12, ALL PUPILS

Geographical Setting of the High School	Region: North and West						Southeast						Total					
	a	E	S	I. Q.	S-E	R^2	a	E	S	I. Q.	S-E	R^2	a	E	S	I. Q.	S-E	R^2
Large Cities	10.69	0.042	-0.042		0.581	.294	(Note possible to compute)						10.40	0.024	-0.041		0.597	.318
	(6.14)	(0.44)	(0.44)		(6.34)								(6.03)	(0.25)	(0.43)		(6.78)	
	14.84	0.009	-0.095	0.367	0.402	.387							14.54	-0.002	-0.091	0.367	0.413	.409
	(5.72)	(0.10)	(1.04)	(3.76)	(4.12)								(5.61)	(0.02)	(1.01)	(3.86)	(4.35)	
	$\bar{x}$ = 84.1		$\bar{s}$ = 7.4		N = 90		$\bar{x}$ = 84.4		$\bar{s}$ = 8.2		N = 4		$\bar{x}$ = 84.1		$\bar{s}$ = 7.3		N = 94	
Urban	33.46	0.029	0.002		0.426	.164	-9.41	0.042	0.064		0.911	.860	-1.96	0.026	0.019		0.830	.704
	(5.09)	(0.33)	(0.02)		(4.79)		(5.46)	(0.81)	(1.17)		(17.14)		(5.39)	(0.60)	(0.45)		(19.18)	
	33.19	-0.004	0.012	0.231	0.312	.196	-8.53	0.058	0.007	0.279	0.688	.876	0.59	-0.009	0.007	0.267	0.631	.728
	(4.99)	(0.05)	(0.14)	(2.41)	(3.14)		(5.14)	(1.18)	(0.12)	(2.78)	(7.28)		(5.17)	(0.23)	(0.17)	(4.07)	(9.85)	
	$\bar{x}$ = 87.4		$\bar{s}$ = 5.6		N = 125		$\bar{x}$ = 80.2		$\bar{s}$ = 14.7		N = 56		$\bar{x}$ = 85.2		$\bar{s}$ = 9.9		N = 181	
Small Town	5.14	0.007	-0.020		0.874	.755	37.09	-0.232	-0.031		0.326	.032	7.19	-0.025	-0.024		0.839	.690
	(7.12)	(0.15)	(0.45)		(20.05)		(9.09)	(1.35)	(0.18)		(1.88)		(7.52)	(0.55)	(0.56)		(19.09)	
	5.14	-0.034	-0.014	0.428	0.540	.824	27.06	-0.267	-0.076	0.417	0.247	.189	7.78	-0.088	-0.025	0.420	0.536	.766
	(6.03)	(0.91)	(0.38)	(7.11)	(9.04)		(8.31)	(1.69)	(0.48)	(2.57)	(1.52)		(6.53)	(2.24)	(0.64)	(7.29)	(9.48)	
	$\bar{x}$ = 82.9		$\bar{s}$ = 14.4		N = 131		$\bar{x}$ = 81.5		$\bar{s}$ = 9.4		N = 33		$\bar{x}$ = 82.6		$\bar{s}$ = 13.6		N = 164	
Rural	4.95	-0.021	-0.032		0.823	.672	7.72	-0.044	0.035		0.765	.580	5.22	-0.015	-0.008		0.810	.644
	(7.68)	(0.40)	(0.61)		(15.80)		(10.84)	(0.59)	(0.46)		(10.02)		(8.94)	(0.35)	(0.18)		(18.71)	
	5.63	-0.039	-0.048	0.288	0.629	.713	11.64	-0.095	-0.042	0.616	0.274	.704	6.71	-0.054	-0.037	0.390	0.523	.707
	(7.18)	(0.79)	(0.96)	(4.20)	(9.21)		(9.11)	(1.50)	(0.65)	(5.52)	(2.50)		(8.11)	(1.36)	(0.94)	(6.48)	(8.83)	
	$\bar{x}$ = 81.9		$\bar{s}$ = 13.5		N = 121		$\bar{x}$ = 76.8		$\bar{s}$ = 16.9		N = 75		$\bar{x}$ = 79.9		$\bar{s}$ = 15.0		N = 196	
Totals	6.44	-0.015	-0.077		0.825	.660	5.82	-0.057	0.028		0.796	.641	4.73	-0.008	-0.057		0.828	.665
	(6.61)	(0.53)	(2.74)		(29.98)		(8.85)	(1.20)	(0.56)		(16.51)		(7.25)	(0.33)	(2.33)		34.99	
	7.22	-0.036	-0.128	0.335	0.596	.712	8.20	-0.076	-0.047	0.464	0.449	.715	6.60	-0.049	-0.109	0.376	0.573	.720
	(6.09)	(1.42)	(4.84)	(9.08)	(16.64)		(7.89)	(1.80)	(1.02)	(6.60)	(6.61)		(6.62)	(2.19)	(4.81)	(11.22)	(17.55)	
	$\bar{x}$ = 84.1		$\bar{s}$ = 11.4		N = 467		$\bar{x}$ = 79.0		$\bar{s}$ = 14.8		N = 168		$\bar{x}$ = 82.7		$\bar{s}$ = 12.5		N = 635	

Notes: Notes for Tables 26-39 appear after Table 39, page 127.

TABLE 34

CROSS-CLASSIFICATION BY REGION AND URBAN CHARACTERISTICS, BETA COEFFICIENTS, MATHEMATICS, GRADE 12, ALL PUPILS

Geographical Setting of the High School	Region: North and West						Southeast						Total					
	a	E	S	I. Q.	S-E	R^2	a	E	S	I. Q.	S-E	R^2	a	E	S	I. Q.	S-E	R^2
Large Cities	-39.48 (3.83)	0.097 (1.12)	0.070 (0.80)		0.650 (7.83)	.419	(Not possible to compute)						-38.13 (3.78)	0.064 (0.74)	0.068 (0.78)		0.658 (8.18)	.430
	-36.62 (3.50)	0.064 (0.80)	0.017 (0.21)	0.369 (4.24)	0.472 (5.43)	.515							-35.25 (3.45)	0.038 (0.48)	0.017 (0.22)	0.372 (4.38)	0.471 (5.54)	.526
	$\bar{x}$ = 19.7		$\bar{s}$ = 5.1		N = 90		$\bar{x}$ = 19.7		$\bar{s}$ = 5.4		N = 4		$\bar{x}$ = 19.7		$\bar{s}$ = 5.0		N = 94	
Urban	-16.39 (2.99)	0.094 (1.13)	-0.090 (1.12)		0.487 (5.73)	.239	-9.80 (4.03)	0.099 (1.00)	0.223 (2.15)		0.616 (6.10)	.493	-11.72 (3.52)	0.236 (4.13)	0.047 (0.82)		0.570 (9.82)	.466
	-16.69 (2.74)	0.034 (0.44)	-0.072 (0.97)	0.421 (4.92)	0.279 (3.15)	.361	-8.86 (3.47)	0.143 (1.67)	0.066 (0.69)	0.763 (4.40)	0.004 (0.02)	.625	-8.98 (3.09)	0.158 (3.09)	0.019 (2.38)	0.591 (7.34)	0.130 (1.65)	.589
	$\bar{x}$ = 21.8		$\bar{s}$ = 3.4		N = 125		$\bar{x}$ = 16.9		$\bar{s}$ = 3.7		N = 56		$\bar{x}$ = 20.3		$\bar{s}$ = 4.8		N = 181	
Small Town	-1.11 (4.27)	0.119 (1.69)	-0.052 (0.74)		0.592 (8.36)	.353	-15.70 (3.82)	-0.062 (0.38)	-0.048 (0.29)		0.473 (2.84)	.112	-2.99 (4.22)	0.201 (3.17)	-0.057 (0.91)		0.559 (8.86)	.362
	-1.11 (3.98)	0.073 (1.09)	-0.046 (0.70)	0.487 (4.54)	0.212 (1.99)	.440	-19.19 (3.63)	-0.090 (0.58)	-0.083 (0.52)	0.330 (2.05)	0.410 (2.55)	.201	-2.74 (3.94)	0.134 (2.22)	-0.058 (0.98)	0.442 (4.98)	0.239 (2.75)	.444
	$\bar{x}$ = 19.8		$\bar{s}$ = 5.3		N = 131		$\bar{x}$ = 16.3		$\bar{s}$ = 4.1		N = 33		$\bar{x}$ = 19.1		$\bar{s}$ = 5.3		N = 164	
Rural	-4.14 (4.82)	0.029 (0.38)	0.062 (0.80)		0.557 (7.25)	.299	-2.46 (5.08)	0.021 (0.21)	-0.018 (0.18)		0.550 (5.43)	.259	-5.22 (4.95)	0.138 (2.35)	0.038 (0.64)		0.560 (9.50)	.340
	-3.74 (4.56)	0.004 (0.06)	0.041 (0.56)	0.390 (3.85)	0.286 (2.83)	.373	-0.78 (4.42)	-0.041 (0.47)	-0.112 (1.25)	0.749 (4.89)	-0.046 (0.31)	.439	-4.47 (4.57)	0.090 (1.64)	0.001 (0.02)	0.482 (5.78)	0.205 (2.49)	.435
	$\bar{x}$ = 19.2		$\bar{s}$ = 5.8		N = 121		$\bar{x}$ = 15.5		$\bar{s}$ = 5.9		N = 75		$\bar{x}$ = 17.8		$\bar{s}$ = 6.1		N = 196	
Totals	-4.84 (4.19)	0.051 (1.31)	-0.043 (1.09)		0.570 (14.60)	.316	-4.75 (4.45)	0.020 (0.31)	0.124 (1.87)		0.561 (8.68)	.355	-6.88 (4.31)	0.155 (4.75)	-0.017 (0.52)		0.579 (17.95)	.378
	-4.36 (3.88)	0.021 (0.59)	-0.113 (3.01)	0.461 (8.76)	0.255 (4.99)	.413	-3.60 (4.00)	-0.005 (0.08)	0.028 (0.45)	0.602 (6.33)	0.111 (1.21)	.479	[illegible]	0.100 ([illegible])	-0.088 (2.84)	0.507 (11.11)	0.220 (5.03)	.479
	$\bar{x}$ = 20.2		$\bar{s}$ = 5.1		N = 467		$\bar{x}$ = 16.2		$\bar{s}$ = 5.6		N = 168		$\bar{x}$ = [illegible]		$\bar{s}$ = 5.5		N = 635	

Notes: Notes for Tables 26-39 appear after Table 39, page 127.

TABLE 35

CROSS-CLASSIFICATION BY REGION AND URBAN CHARACTERISTICS, BETA COEFFICIENTS, GENERAL SCHOOL APTITUDE, GRADE 12, ALL PUPILS

Region: North and West

Geographical Setting of the High School	a	E	S	I. Q.	S-E	R^2
Large Cities	-370.80	.092	.024		.649	.397
	(59.84)	(1.04)	(0.26)		(7.67)	
	-313.03	0.048	-0.046	0.485	0.414	.568
	(50.68)	(0.64)	(0.60)	(5.91)	(5.04)	
	$\bar{x}$ = 525.5		$\bar{s}$ = 77.5		N = 90	
Urban	-99.40	0.099	-0.054		0.559	.327
	(41.90)	(1.27)	(0.71)		(7.01)	
	-104.48	0.031	-0.033	0.479	0.323	.488
	(36.53)	(0.45)	(0.50)	(6.26)	(4.07)	
	$\bar{x}$ = 556.0		$\bar{s}$ = 51.3		N = 125	
Small Town	1.42	0.086	-0.038		0.774	.600
	(65.47)	(1.55)	(0.68)		(13.90)	
	1.39	0.028	-0.030	0.607	0.300	.740
	(52.83)	(0.62)	(0.67)	(8.31)	(4.13)	
	$\bar{x}$ = 518.0		$\bar{s}$ = 104.0		N = 131	
Rural	-31.83	0.017	0.019		0.744	.541
	(68.55)	(0.28)	(0.30)		(11.98)	
	-22.91	-0.014	-0.008	0.499	0.397	.669
	(58.26)	(0.27)	(0.16)	(6.78)	(5.41)	
	$\bar{x}$ = 503.5		$\bar{s}$ = 101.7		N = 121	
Totals	-36.13	0.039	-0.045		0.739	.535
	(60.81)	(1.20)	(1.37)		(22.91)	
	-25.97	0.003	-0.129	0.553	0.359	.675
	(50.80)	(0.12)	(4.61)	(14.14)	(9.46)	
	$\bar{x}$ = 525.9		$\bar{s}$ = 89.2		N = 467	

Region: Southeast

Geographical Setting of the High School	a	E	S	I. Q.	S-E	R^2
Large Cities	(Not possible to compute)					
	$\bar{x}$ = 519.1		$\bar{s}$ = 93.0		N = 4	
Urban	-148.92	0.066	0.188		0.784	.728
	(57.95)	(0.91)	(2.47)		(10.61)	
	-134.38	0.101	0.064	0.606	0.301	.811
	(48.28)	(1.65)	(0.94)	(4.89)	(2.58)	
	$\bar{x}$ = 473.9		$\bar{s}$ = 112.1		N = 56	
Small Town	-57.40	-0.135	-0.022		0.444	.097
	(69.46)	(0.81)	(0.13)		(2.65)	
	-167.44	-0.184	-0.084	0.578	0.334	.433
	(55.02)	(1.40)	(0.63)	(4.27)	(2.46)	
	$\bar{x}$ = 466.9		$\bar{s}$ = 74.2		N = 33	
Rural	-21.22	0.029	0.034		0.678	.437
	(90.22)	(0.33)	(0.39)		(7.67)	
	18.32	-0.044	-0.075	0.865	-0.011	.683
	(67.66)	(0.66)	(1.10)	(7.50)	(0.09)	
	$\bar{x}$ = 439.2		$\bar{s}$ = 121.0		N = 75	
Totals	-50.16	0.006	0.106		0.701	.534
	(75.16)	(0.11)	(1.88)		(12.76)	
	-23.62	-0.023	-0.005	0.695	0.181	.702
	(60.12)	(0.52)	(0.11)	(9.66)	(2.61)	
	$\bar{x}$ = 458.1		$\bar{s}$ = 110.4		N = 168	

Region: Total

Geographical Setting of the High School	a	E	S	I. Q.	S-E	R^2
Large Cities	-368.46	.071	.020		.663	.418
	(58.92)	(0.81)	(0.23)		(8.15)	
	-310.58	0.037	-0.046	0.485	0.419	.585
	(49.78)	(0.50)	(0.60)	(6.09)	(5.27)	
	$\bar{x}$ = 525.2		$\bar{s}$ = 77.7		N = 94	
Urban	-154.67	0.171	0.054		0.729	.650
	(49.70)	(3.69)	(1.16)		(15.50)	
	-110.37	0.099	0.028	0.548	0.321	.756
	(41.49)	(2.50)	(0.73)	(8.83)	(5.29)	
	$\bar{x}$ = 530.6		$\bar{s}$ = 84.2		N = 181	
Small Town	-16.20	0.133	0.042		0.734	.564
	(66.23)	(2.53)	(0.80)		(14.08)	
	-9.93	0.043	-0.042	0.594	0.304	.718
	(53.27)	(0.99)	(0.99)	(9.40)	(4.91)	
	$\bar{x}$ = 507.7		$\bar{s}$ = 100.6		N = 164	
Rural	-49.16	0.100	0.025		0.716	.533
	(77.45)	(2.03)	(0.51)		(14.44)	
	-31.83	0.041	-0.020	0.597	0.276	.682
	(63.92)	(1.00)	(0.49)	(9.54)	(4.48)	
	$\bar{x}$ = 478.9		$\bar{s}$ = 113.6		N = 196	
Totals	-71.04	0.115	-0.019		0.732	.566
	(65.55)	(4.20)	(0.71)		(27.20)	
	-47.45	0.050	-0.103	0.595	0.311	.706
	(53.95)	(2.21)	(4.42)	(17.36)	(9.48)	
	$\bar{x}$ = 507.9		$\bar{s}$ = 99.6		N = 635	

Notes: Notes for Tables 26-39 appear after Table 39, page 127.

TABLE 36

CROSS-CLASSIFICATION BY REGION AND URBAN CHARACTERISTICS, BETA COEFFICIENTS,
GENERAL TECHNICAL APTITUDE, GRADE 12, ALL PUPILS

Geographical Setting of the High School	Region: North and West						Southeast						Total					
	a	E	S	I. Q.	S-E	R^2	a	E	S	I. Q.	S-E	R^2	a	E	S	I. Q.	S-E	R^2
Large Cities	-50.01 (9.24)	-0.001 (0.01)	0.007 (0.07)		0.530 (5.60)	.246	(Not possible to compute)						-52.91 (9.13)	0.007 (0.07)	-0.016 (0.16)		0.550 (6.02)	.267
	-40.84 (7.73)	-0.050 (0.60)	-0.087 (1.03)	0.558 (6.15)	0.260 (2.86)	.472							-43.78 (7.66)	-0.031 (0.38)	-0.091 (1.08)	0.554 (6.24)	0.271 (3.05)	.485
	$\bar{x}$ = 45.9		$\bar{s}$ = 10.7		N = 90		$\bar{x}$ = 43.9		$\bar{s}$ = 12.8		N = 4		$\bar{x}$ = 45.9		$\bar{s}$ = 10.7		N = 94	
Urban	-20.54 (6.11)	0.106 (1.26)	-0.168 (2.06)		0.458 (5.33)	.218	-20.29 (10.24)	0.123 (1.15)	0.123 (1.09)		0.610 (5.59)	.407	-19.96 (7.85)	0.221 (3.74)	-0.020 (0.34)		0.575 (9.58)	.430
	21.31 (5.24)	0.029 (0.40)	-0.144 (2.07)	0.541 (6.66)	0.191 (2.28)	.425	-18.69 (9.67)	0.155 (1.52)	0.008 (0.07)	0.560 (2.70)	0.164 (0.84)	.471	-14.14 (6.99)	0.144 (2.68)	-0.047 (0.89)	0.582 (6.89)	0.142 (1.72)	.548
	$\bar{x}$ = 51.3		$\bar{s}$ = 6.9		N = 125		$\bar{x}$ = 41.6		$\bar{s}$ = 13.4		N = 56		$\bar{x}$ = 48.3		$\bar{s}$ = 10.4		N = 181	
Small Town	-2.07 (9.95)	0.099 (1.43)	-0.084 (1.23)		0.627 (9.12)	.391	-39.33 (10.25)	-0.028 (0.17)	-0.077 (0.45)		0.444 (2.62)	.080	-7.43 (10.12)	0.193 (3.12)	-0.089 (1.43)		0.580 (9.38)	.386
	-2.07 (8.85)	0.042 (0.69)	-0.077 (1.25)	0.585 (5.88)	0.170 (1.72)	.518	-56.00 (7.97)	-0.079 (0.60)	-0.141 (1.06)	0.599 (4.46)	0.329 (2.45)	.443	-6.63 (8.80)	0.105 (1.89)	-0.089 (1.65)	0.588 (7.25)	0.155 (1.94)	.536
	$\bar{x}$ = 49.4		$\bar{s}$ = 12.8		N = 131		$\bar{x}$ = 40.1		$\bar{s}$ = 10.9		N = 33		$\bar{x}$ = 47.5		$\bar{s}$ = 13.0		N = 164	
Rural	-4.17 (10.45)	0.051 (0.66)	0.045 (0.58)		0.572 (7.53)	.313	-1.36 (10.90)	0.086 (0.87)	-0.071 (0.70)		0.561 (5.56)	.266	-7.13 (10.77)	0.190 (3.30)	0.012 (0.21)		0.563 (9.73)	.363
	-2.91 (9.12)	0.015 (0.22)	0.014 (0.21)	0.567 (6.12)	0.179 (1.94)	.477	3.47 (8.10)	0.003 (0.04)	-0.196 (2.56)	0.998 (7.65)	-0.234 (1.82)	.595	-4.84 (9.09)	0.125 (2.53)	-0.038 (0.77)	0.662 (8.85)	0.075 (1.02)	.546
	$\bar{x}$ = 48.7		$\bar{s}$ = 12.7		N = 121		$\bar{x}$ = 39.1		$\bar{s}$ = 12.8		N = 75		$\bar{x}$ = 45.0		$\bar{s}$ = 13.5		N = 196	
Totals	-5.87 (9.21)	0.059 (1.52)	-0.183 (4.64)		0.577 (14.87)	.325	-7.53 (10.46)	0.065 (0.99)	0.025 (0.36)		0.558 (8.33)	.308	-11.00 (9.69)	0.181 (5.49)	-0.136 (4.10)		0.581 (17.88)	.370
	-4.51 (8.04)	0.021 (0.62)	-0.273 (7.75)	0.591 (11.99)	0.172 (3.60)	.485	-4.22 (8.82)	0.034 (0.61)	-0.096 (1.61)	0.759 (8.21)	-0.010 (0.12)	.507	-7.89 (8.36)	0.111 (3.87)	-0.226 (7.69)	0.639 (14.76)	0.128 (3.09)	.531
	$\bar{x}$ = 49.1		$\bar{s}$ = 11.2		N = 467		$\bar{x}$ = 40.2		$\bar{s}$ = 12.6		N = 168		$\bar{x}$ = 46.7		$\bar{s}$ = 12.2		N = 635	

Notes: Notes for Tables 26-39 appear after Table 39, page 127.

TABLE 37

CROSS-CLASSIFICATION BY REGION AND URBAN CHARACTERISTICS, BETA COEFFICIENTS, ENGLISH FACTOR, GRADE 12, ALL PUPILS

Geographical Setting of the High School	Region: North and West a	E	S	I. Q.	S-E	R^2	Southeast a	E	S	I. Q.	S-E	R^2	Total a	E	S	I. Q.	S-E	R^2
Large Cities	31.28 (6.51)	-0.010 (0.09)	-0.109 (0.94)		0.168 (1.53)	.000	(Not possible to compute)						30.56 (6.39)	-0.029 (0.25)	-0.105 (0.91)		0.183 (1.72)	.000
	27.71 (6.23)	0.022 (0.20)	-0.058 (0.52)	-0.357 (2.97)	0.341 (2.84)	.074							27.08 (6.13)	-0.005 (0.04)	-0.057 (0.51)	-0.353 (2.98)	0.361 (3.05)	.080
	$\bar{x}$ = 47.9		$\bar{s}$ = 6.5	N = 90			$\bar{x}$ = 49.6		$\bar{s}$ = 4.3	N = 4			$\bar{x}$ = 48.0		$\bar{s}$ = 6.4	N = 94		
Urban	40.79 (5.31)	-0.052 (0.54)	0.059 (0.64)		0.083 (0.84)	.000	-0.40 (6.39)	-0.021 (0.24)	0.010 (0.10)		0.775 (8.42)	.578	6.04 (5.76)	-0.109 (1.72)	0.015 (0.24)		0.611 (9.45)	.338
	41.08 (5.20)	-0.014 (0.14)	0.048 (0.52)	-0.270 (2.55)	0.216 (1.97)	.024	-0.97 (6.32)	-0.037 (0.41)	0.064 (0.64)	-0.269 (1.47)	0.990 (5.75)	.587	4.29 (5.67)	-0.076 (1.18)	0.027 (0.43)	-0.256 (2.54)	0.802 (8.15)	.358
	$\bar{x}$ = 50.2		$\bar{s}$ = 5.3	N = 125			$\bar{x}$ = 48.0		$\bar{s}$ = 9.9	N = 56			$\bar{x}$ = 49.6		$\bar{s}$ = 7.1	N = 181		
Small Town	5.93 (7.01)	-0.049 (0.78)	0.005 (0.09)		0.714 (11.39)	.493	52.41 (7.54)	-0.308 (1.75)	-0.075 (0.42)		-0.056 (0.31)	.000	10.34 (7.24)	-0.154 (2.54)	-0.010 (0.17)		0.656 (10.90)	.418
	5.93 (6.97)	-0.064 (1.01)	0.007 (0.12)	0.155 (1.53)	0.593 (5.88)	.498	53.96 (7.65)	-0.301 (1.68)	-0.067 (0.37)	-0.080 (0.43)	0.071 (0.38)	.000	10.42 (7.24)	-0.167 (2.69)	-0.010 (0.17)	0.087 (0.96)	0.593 (6.66)	.417
	$\bar{x}$ = 48.2		$\bar{s}$ = 9.9	N = 131			$\bar{x}$ = 51.1		$\bar{s}$ = 7.6	N = 33			$\bar{x}$ = 48.8		$\bar{s}$ = 9.5	N = 164		
Rural	4.84 (8.74)	-0.018 (0.24)	-0.062 (0.82)		0.594 (7.88)	.325	6.21 (8.67)	-0.051 (0.59)	-0.008 (0.09)		0.681 (7.73)	.441	7.16 (8.67)	-0.096 (1.68)	-0.046 (0.80)		0.634 (11.09)	.380
	4.66 (8.75)	-0.012 (0.16)	-0.057 (0.74)	-0.097 (0.93)	0.661 (6.30)	.324	7.42 (8.53)	-0.074 (0.86)	-0.043 (0.48)	0.275 (1.82)	0.462 (3.12)	.458	7.20 (8.70)	-0.097 (1.67)	-0.047 (0.81)	0.012 (0.14)	0.625 (7.24)	.377
	$\bar{x}$ = 48.0		$\bar{s}$ = 10.7	N = 121			$\bar{x}$ = 47.8		$\bar{s}$ = 11.7	N = 75			$\bar{x}$ = 47.9		$\bar{s}$ = 11.0	N = 196		
Totals	8.45 (7.04)	-0.044 (1.14)	-0.108 (2.73)		0.583 (15.01)	.324	7.84 (7.69)	-0.097 (1.64)	-0.046 (0.75)		0.674 (11.16)	.437	8.98 (7.22)	-0.107 (3.22)	-0.097 (2.89)		0.621 (18.98)	.360
	8.25 (7.02)	-0.037 (0.96)	-0.091 (2.26)	-0.109 (1.94)	0.658 (12.04)	.328	8.03 (7.71)	-0.099 (1.67)	-0.055 (0.86)	0.056 (0.56)	0.632 (6.61)	.435	8.70 (7.21)	-0.098 (2.93)	-0.086 (2.52)	-0.077 (1.53)	0.675 (13.94)	.362
	$\bar{x}$ = 48.6		$\bar{s}$ = 8.6	N = 467			$\bar{x}$ = 48.6		$\bar{s}$ = 10.3	N = 168			$\bar{x}$ = 48.6		$\bar{s}$ = 9.03	N = 635		

Notes: Notes for Tables 26-39 appear after Table 39, page 127.

TABLE 38

CROSS-CLASSIFICATION BY REGION AND URBAN CHARACTERISTICS, BETA COEFFICIENTS, MATHEMATICS FACTOR, GRADE 12, ALL PUPILS

Region: North and West

Geographical Setting of the High School	a	E	S	I. Q.	S-E	R^2
Large Cities	-8.40 (7.86)	0.130 (1.21)	0.081 (0.75)		0.358 (3.50)	.120
	-5.93 (7.78)	0.113 (1.06)	0.054 (0.49)	0.191 (1.65)	0.266 (2.29)	.138
	$\bar{x}$ = 50.4		$\bar{s}$ = 8.4		N = 90	
Urban	0.45 (6.09)	0.117 (1.31)	-0.066 (0.76)		0.330 (3.60)	.113
	0.03 (5.86)	0.072 (0.82)	-0.052 (0.63)	0.317 (3.27)	0.173 (1.73)	.179
	$\bar{x}$ = 50.3		$\bar{s}$ = 6.5		N = 125	
Small Town	-0.10 (9.19)	0.064 (0.92)	-0.022 (0.32)		0.632 (9.17)	.388
	-0.10 (9.22)	0.058 (0.83)	-0.021 (0.31)	0.057 (0.51)	0.587 (5.26)	.385
	$\bar{x}$ = 47.7		$\bar{s}$ = 11.8		N = 131	
Rural	2.48 (9.22)	0.013 (0.17)	0.039 (0.52)		0.585 (7.78)	.327
	2.53 (9.26)	0.011 (0.15)	0.038 (0.50)	0.024 (0.23)	0.568 (5.41)	.322
	$\bar{x}$ = 49.5		$\bar{s}$ = 11.3		N = 121	
Totals	0.95 (8.22)	0.066 (1.69)	-0.015 (0.37)		0.558 (14.21)	.310
	1.15 (8.20)	0.060 (1.52)	-0.030 (0.73)	0.099 (1.74)	0.490 (8.86)	.313
	$\bar{x}$ = 49.3		$\bar{s}$ = 9.9		N = 467	

Region: Southeast

Geographical Setting of the High School	a	E	S	I. Q.	S-E	R^2
Large Cities	(not possible to compute)					
	$\bar{x}$ = 49.1		$\bar{s}$ = 2.8		N = 4	
Urban	13.06 (6.69)	-0.056 (0.52)	-0.103 (0.90)		0.677 (6.12)	.392
	12.94 (6.75)	-0.060 (0.55)	-0.089 (0.72)	-0.068 (0.30)	0.731 (3.47)	.381
	$\bar{x}$ = 47.3		$\bar{s}$ = 8.7		N = 56	
Small Town	5.56 (6.44)	0.064 (0.37)	-0.133 (0.76)		0.362 (2.07)	.021
	9.38 (6.38)	0.083 (0.48)	-0.109 (0.63)	-0.225 (1.28)	0.405 (2.30)	.042
	$\bar{x}$ = 46.2		$\bar{s}$ = 6.6		N = 33	
Rural	11.52 (8.64)	-0.076 (0.84)	-0.100 (1.09)		0.643 (6.93)	.380
	11.19 (8.69)	-0.070 (0.75)	-0.091 (0.95)	-0.078 (0.48)	0.705 (4.42)	.373
	$\bar{x}$ = 46.4		$\bar{s}$ = 11.1		N = 75	
Totals	11.40 (7.45)	-0.054 (0.85)	-0.089 (1.34)		0.630 (9.81)	.364
	10.97 (7.43)	-0.049 (0.77)	-0.068 (0.99)	-0.131 (1.25)	0.728 (7.19)	.366
	$\bar{x}$ = 46.7		$\bar{s}$ = 9.4		N = 168	

Region: Total

Geographical Setting of the High School	a	E		I. Q.	S-E	R^2
Large Cities	-3.74 (7.73)	0.116 (1.07)	0.086 (0.78)		0.346 (3.44)	.114
	-1.33 (7.66)	0.103 (0.96)	0.060 (0.55)	0.190 (1.65)	0.250 (2.17)	.130
	$\bar{x}$ = 50.3		$\bar{s}$ = 8.3		N = 94	
Urban	8.34 (6.24)	0.093 (1.39)	-0.078 (1.18)		0.522 (7.70)	.273
	9.82 (6.19)	0.065 (0.96)	-0.088 (1.33)	0.210 (1.98)	0.366 (3.52)	.285
	$\bar{x}$ = 49.3		$\bar{s}$ = 7.3		N = 181	
Small Town	1.02 (8.65)	0.053 (0.85)	-0.035 (0.56)		0.617 (9.87)	.373
	1.01 (8.67)	0.054 (0.84)	-0.035 (0.56)	-0.005 (0.06)	0.620 (6.69)	.369
	$\bar{x}$ = 47.4		$\bar{s}$ = 11.0		N = 164	
Rural	5.54 (8.97)	-0.001 (0.01)	0.005 (0.09)		0.614 (10.61)	.363
	5.50 (8.99)	0.001 (0.02)	-0.004 (0.07)	-0.014 (0.15)	0.624 (7.13)	.360
	$\bar{x}$ = 48.3		$\bar{s}$ = 11.3		N = 196	
Totals	5.22 (8.03)	0.037 (1.09)	-0.019 (0.57)		0.574 (17.13)	.328
	5.36 (8.04)	0.033 (0.96)	-0.025 (0.70)	0.037 (0.72)	0.548 (11.02)	.328
	$\bar{x}$ = 48.7		$\bar{s}$ = 9.8		N = 635	

Notes: Notes for Tables 26-39 appear after Table 39, page 127.

TABLE 39

CROSS-CLASSIFICATION BY REGION AND URBAN CHARACTERISTICS, BETA COEFFICIENTS, CURRICULUM MEASURE, GRADE 12, ALL PUPILS

Geographical Setting of the High School	Region: North and West						Southeast						Total					
	a	E	S	I. Q.	S-E	R^2	a	E	S	I. Q.	S-E	R^2	a	E	S	I. Q.	S-E	R^2
Large Cities	75.58 (19.74)	-0.110 (1.14)	0.591 (6.06)		0.004 (0.04)	.286	(Not possible to compute.)						90.39 (20.02)	-0.143 (1.45)	0.580 (5.79)		-0.024 (0.26)	.253
	80.31 (19.68)	-0.122 (1.26)	0.571 (5.82)	0.131 (1.25)	-0.060 (0.57)	.291							95.31 (19.95)	-0.153 (1.54)	0.561 (5.57)	0.137 (1.29)	-0.093 (0.88)	.259
	$\bar{x}$ = 90.9		$\bar{s}$ = 23.5		N = 90		$\bar{x}$ = 88.8		$\bar{s}$ = 21.0		N = 4		$\bar{x}$ = 90.8		$\bar{s}$ = 23.3		N = 94	
Urban	11.99 (19.27)	0.116 (1.42)	0.475 (5.99)		0.080 (0.95)	.255	10.32 (16.39)	0.232 (1.77)	0.189 (1.38)		0.220 (1.65)	.117	15.89 (18.75)	0.248 (3.84)	0.418 (6.49)		0.113 (1.71)	.318
	11.37 (19.18)	0.097 (1.18)	0.481 (6.09)	0.135 (1.46)	0.014 (0.14)	.262	9.52 (16.45)	0.219 (1.66)	0.233 (1.57)	-0.212 (0.79)	0.389 (1.54)	.111	17.31 (13.78)	0.239 (3.62)	0.415 (6.42)	0.065 (0.63)	0.064 (0.63)	.315
	$\bar{x}$ = 76.4		$\bar{s}$ = 22.4		N = 125		$\bar{x}$ = 57.5		$\bar{s}$ = 17.6		N = 56		$\bar{x}$ = 70.5		$\bar{s}$ = 22.8		N = 181	
Small Town	28.33 (13.27)	0.080 (1.11)	0.582 (8.07)		0.056 (0.78)	.329	-45.62 (14.13)	0.174 (1.02)	0.061 (0.35)		0.340 (1.98)	.049	25.58 (14.22)	0.160 (2.27)	0.451 (6.42)		0.087 (1.24)	.209
	28.33 (13.09)	0.104 (1.47)	0.579 (8.14)	-0.248 (2.14)	0.249 (2.17)	.347	-49.02 (14.32)	0.167 (0.96)	0.051 (0.29)	0.090 (0.51)	0.323 (1.82)	.024	25.29 (14.15)	0.185 (2.58)	0.451 (6.45)	-0.169 (1.61)	0.209 (2.02)	.217
	$\bar{x}$ = 53.9		$\bar{s}$ = 16.3		N = 131		$\bar{x}$ = 49.1		$\bar{s}$ = 14.7		N = 33		$\bar{x}$ = 52.9		$\bar{s}$ = 16.0		N = 164	
Rural	34.13 (14.98)	0.077 (0.96)	0.504 (6.22)		0.040 (0.50)	.231	31.77 (12.10)	-0.064 (0.61)	0.464 (4.40)		0.062 (0.59)	.192	25.67 (14.06)	0.191 (3.05)	0.480 (7.65)		0.077 (1.22)	.251
	34.73 (14.84)	0.064 (0.80)	0.493 (6.12)	0.199 (1.79)	-0.098 (0.88)	.245	30.98 (12.12)	-0.051 (0.48)	0.484 (4.47)	-0.154 (0.84)	0.185 (1.02)	.188	26.16 (14.04)	0.179 (2.83)	0.471 (7.46)	0.117 (1.22)	-0.010 (0.10)	.253
	$\bar{x}$ = 51.4		$\bar{s}$ = 17.2		N = 121		$\bar{x}$ = 43.5		$\bar{s}$ = 13.5		N = 75		$\bar{x}$ = 48.4		$\bar{s}$ = 16.3		N = 196	
Totals	32.80 (18.55)	-0.003 (0.08)	0.656 (18.57)		0.099 (2.85)	.458	19.50 (15.61)	0.122 (1.72)	0.356 (4.83)		0.162 (2.24)	.200	22.87 (17.96)	0.088 (2.89)	0.611 (19.82)		0.125 (4.17)	.459
	33.32 (18.49)	-0.009 (0.27)	0.640 (17.78)	0.100 (1.98)	0.031 (0.63)	.462	19.24 (15.65)	0.124 (1.74)	0.363 (4.75)	-0.042 (0.36)	0.193 (1.69)	.196	23.74 (17.92)	0.079 (2.55)	0.599 (19.04)	0.090 (1.93)	0.062 (1.39)	.462
	$\bar{x}$ = 66.5		$\bar{s}$ = 25.2		N = 467		$\bar{x}$ = 50.3		$\bar{s}$ = 17.5		N = 168		$\bar{x}$ = 62.2		$\bar{s}$ = 24.4		N = 635	

Notes: Notes for Tables 26-39 appear after Table 39, page 127.

Notes Tables 26-39

Table Format

For the fifteen combinations of high schools denoted by the row and column headings, two complete multiple regression equations are given, one including and one excluding the pupil intelligence variable. The value under the columns headed by an "a" is the intercept and the value in parentheses under the intercept is the standard error of the estimate. The other column headings are to be interpreted as follows:

E = Expenditure per pupil in average daily attendance
S = Size of high school in average daily attendance
I. Q. = Average pupil score on the Verbal Knowledge Factor Score
S-E = Average value of the Project Talent pupil socio-economic index.
R^2 = Coefficient of multiple determination, corrected for degrees of freedom lost.

The values in these columns not enclosed in parentheses are the beta coefficients of net regression. The values enclosed in parentheses under the beta coefficients are values of the computed t-statistic.

Other information is given in each category as follows:

$\bar{x}$ = Mean value of the dependent variable (e.g., English Score in Table 26).
$\bar{s}$ = Standard deviation of the dependent variable.
N = Total number of high schools

Statistical Significance

Because these tables are quite complicated already, asterisks for the purpose of denoting statistical significance have been omitted

The following information is included so the reader can evaluate statistical significance. To arrive at a figure for degrees of freedom, subtract the number of variables (including the intercept) in the multiple regression equation from the number of high schools, N. The t- value is statistically significant if greater than the following listed values.

Number of degrees of freedom	Value of t for significance at 95%	Value of t for significance at 99%
27	2.05	2.77
100	1.98	2.63
500	1.96	2.59

negative as the pupils move through the grades have been discussed in detail above and is consistent with hypotheses advanced in Part II concerning the English score.

When intelligence is omitted from the ultiple regression equation, the relationships usually become a great deal more positive, especially in Northern school populations. The relationship in all the Southeastern classifications remains meaningless, however. The lack of a significant expenditure-performance relationship in the 12 Southern states is a finding that is repeated consistently in the findings for all seven of these quality measures.

2. Mathematics Score

The relationship of the Mathematics score to high school expenditure is much more positive in general than is the English score, again a possible ramification of the fact that the Mathematics score is a better quality measure than is the English score as has been suggested repeatedly above. The positive relationship is more significant at the 9th grade level than in grade 12, however, a finding which is contrary to an hypothesis made above. Again the omission of the intelligence variable from the multiple regression equation serves to make the relationships larger and more significant. There is some hint of a meaningful expenditure performance relationship in the high schools in the urban Southeast, but no other Southeastern high schools display any relationship between expenditure and performance. This is also true with the high schools that are found in rural settings and in large cities, and, in grade 12, in the Northern, urban, and small town high schools. Thus, the only cross-classified populations in which expenditure is meaningfully related to Mathematics achievement is the Northern, urban, and small town high schools in grade 9. This lack of relationship within the eight cross-classification cells is generally true for the other performance measures as well. The relationships for all urban, small town, and rural high schools, respectively, are on the other hand quite strong.

3. and 4. General School Aptitude Score and General Technical Aptitude Score

The findings for these two scores are very similar and therefore it is convenient to discuss them together. Both scores are related positively to school expenditure for aggregated urbanness classifications and for all pupils taken together. The deletion of the intelligence variable from the regression equation tends to make the relationships in the Northern populations much more significant and positive at both grade levels (except in the large city schools). It is interesting that for both variables in grade 9 the expenditure performance relationship becomes less pronounced with the deletion of the intelligence variable in the urban South, which is the only Southern population of high schools which had otherwise had a meaningful relationship. For both output measures the relationship of expenditure to performance in all high schools classified according to urbanness and in all the high schools in the sample is quite strong.

5. English Factor Score

The findings for the English Factor score are again consistent with the hypothesis developed above that the English Factor is a poor measure of school quality. In the 9th grade the relationships are positive but not statistically significant. In grade 12 the relationships are even less positive than in grade 9 with a number of negative relationships that are statistically significant.

6. The Mathematics Factor Score

The findings for the expenditure relationship to the Mathematics Factor score are quite disappointing. This is especially true when the complete model is used when there are no significant relationships in grade 12 and a general negative relationship in grade 9. The findings when the intelligence variable is not included in the equations are more positive although still not very strong. In the 9th grade significant relationships obtain in the Northern small towns and in all small towns. In the 12th grade there are no populations where expenditure is significantly and positively related to the Mathematics Factor.

7. The Curriculum Measure

In most populations of high schools the breadth of school curriculum is positively related to expenditure but little more. The relationships are not strong except for in all schools taken together and for all urban, small town, and rural high schools respectively.

Cross-Classification Findings: Size

The overall size finding contained in Tables 29 through 42, with the exception of those for the curriculum measure, display two overall characteristics. First, the relationship of size to performance becomes more negative as the high school population involved becomes more aggregated, and secondly, the size-performance relationships become more negative when the control variables are entered into the multiple regression equation.[49]

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[49]That this is true for the introduction of the intelligence variable the reader can see by examining the table. A very similar result obtains also when the socio-economic index variable is entered into the equation.

Both of these tendencies have already been discussed above, the former in the section just preceding this one, and the latter in the dummy variable section with respect to size. In the latter section, reasons were given as to why the negative size findings which obtain when the two control variables are entered into the regression equation might be more believable than the more positive findings when those two variables are omitted.[50] Also above (Page 105) were given some reasons why the urbanness categories might be truly more homogeneous than the regions.[51] If this is true, we should pay particular attention to the size relationships within each of the urbanness categories because, if a consistent negative relationship were found within categories which were thought to be in other respects similar, such might constitute important evidence for diseconomies of scale. Such a consistent negative relationship does not seem to be present, however, with the exception of the relationship of size to the Technical Aptitude and Mathematics Factor scores in the urban and small town districts. Since, as was discussed above, these two scores are important measures of school performance, these two exceptions should perhaps be assigned some importance. Nevertheless, there is no consistent overall negative relationship within these categories. The only consistent negative relationships seem to obtain for all Northern high schools and for all high schools taken together.

General Summary: Findings When the High Schools are Cross-Classified According to Urbanness and Region

In summary, then, when the high schools are cross-classified both according to urbanness and region, the expenditure-performance and size-performance relationships are both quite weak. When more aggregated groupings of high schools are considered, the relationships seem better defined and this is more true in the non-Southeastern and non-large-city high schools. Deletion of the

[50] The complete model may be more accurate with respect to the size variable than the school expenditure variable because there is less reason to believe that the intelligence variable overlaps with the size variable to the extent that it does with the expenditure variable.

[51] These reasons were given when there were three regions in the analysis instead of two, however. The division between the Southeastern region and the rest of the country is probably more meaningful than the three-region breakdown used in the preceding section.

intelligence variable (and also the socio-economic variable, not shown) from the multiple regression equation makes most of the expenditure-performance relationships more significantly positive and most of the size relationships more positive. Of the Southeastern categories, the urban high schools seem to have performance which is more highly related to higher spending schools than any of the others. The differences in the relative expenditure-performance relationships between the seven quality measures were found to be about the same as they were above, although the expenditure relationships to the Mathematics Factor score was perhaps somewhat weaker. In general, the model explains the traditional achievement measures better than the factor measures. Finally, with respect to the relationship to performance of school size, it might be possible to reason that the overall negative relationships which have been demonstrated to exist throughout the study for all high schools are due to geographical differences according to urbanness, at least if such differences are themselves significant. This same argument does not of course work in similar fashion for explaining insignificant expenditure-performance relationships in the cross-classified populations since expenditure is highly associated with performance in three of the four total urbanness categories.

PART V

SUMMARY AND CONCLUSIONS

There have been three basic objectives to this study. The first, which provided the subject matter of Part II, was to see if something could not be learned within the professional competence of the author about the efficacy of various quality measures of school performance. From that analysis some tentative conclusions were reached concerning which of a number of quality measures were most useful.

The second purpose of the study was to explore carefully the relationship of expenditure levels to school quality as measured by pupil performance. This procedure makes the implicit assumption that "better" schools are those which, other things equal, average more expenditure per pupil. Part of the purpose of examining the expenditure relationship, also, was to examine how educational returns vary with differences in the socio-economic background of the individual pupils.

Most of the studies of school performance which were discussed in Part I found that the formal education process has little influence upon educational quality after accounting for pupil intelligential and environmental differences, even though the apparent relationship, before accounting for these important things, is very large. The findings for expenditure in Part III do not warrant a similar conclusion for the Project Talent high schools, at least when all of them are considered together. Considerable variation in performance was explained by expenditure per pupil at advanced levels of statistical significance even after carefully accounting for intelligence once and socio-economic background twice. After allowing for these control variables, it was often found for the better measures of quality that an additional $100 of expenditure per pupil was associated with between .1 and .2 of a standard deviation in the dependent variable. This is no small effect.

It was also found (Table 3) that three of the most important school characteristics are quite highly related to expenditure per pupil, even after allowing for intelligence and socio-economic background. The relationship was especially large for starting salary of male teachers and class size in non-science and mathematics courses where the amount of pupil performance associated with one standard deviation of these variables was often close to .2 of a standard deviation of the dependent variable at highly meaningful levels of statistical significance. Thus it would appear that the present study has been unique in showing considerable relationship between these variables and school quality after carefully accounting for intelligential and socio-economic differences.[52]

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[52]Another study which was in part also successful in doing this was the large school districts in the author's prior study of school districts in New York State. (See Kiesling, Review of Economics and Statistics, op. cit.)

Part III also contains a detailed discussion of the theoretical considerations which went into the construction of the analytical model. Since there is good reason to suspect that an explanatory variable for intelligence often overlaps with the measures of performance, a section was devoted to an empirical investigation meant to show what the maximum effect of such overlap might be.

There were also interesting findings in Part III concerning the effects of school and socio-economic variables upon pupils from different home environments. Thus, the background of classmates seems to be more important to the progress of children from low socio-economic backgrounds and school expenditure more important to children from good home environments.

A major task of the study has been to explore in great detail the shape or the functional form of the relationships between expenditure and school quality with the use of dummy variables. That is to say, the purpose was to explore whether there are any ranges of expenditure per pupil which seem to be associated with greater returns than other ranges. These detailed relationships are contained in Charts 1-30, where it appears that expenditure-performance relationships are linear to a surprisingly consistent degree. When the relationships are not linear, it appears as if expenditure levels beyond $400-$500 of expenditure per pupil seem to yield less return per dollar than lower levels. Many of such relationships would be accurately represented by a logarithmic function in which the expenditure performance relationship increases more quickly at first and then more slowly thereafter.

A final major objective of the study was to inquire into the relationship between performance and school size. This question was analyzed both with the use of a continuous size variable and with dummy variables for size intervals in the same fashion as was done for the expenditure-performance relationship. The overall size performance relationship found in the data, especially when allowance was made for the effects of pupil intelligence and socio-economic background, was negative with surprising consistency. This finding is modified considerably when the high schools are divided into groupings according to region and urbanness characteristics, however. None the less, there is little evidence in the study that larger high schools are more efficient high schools, while there is considerable evidence that larger high schools are <u>less</u> efficient. In an age of school consolidation, this should serve as at least a word of caution.

When the Project Talent high schools were considered in regional and/or urbanness categories, however, the picture with respect to school influence upon pupil performance becomes more clouded. Within the populations which were cross-classified both by region and by urbanness, expenditure was rarely related to anything, although some fairly strong relationships remained when the separations were made according to urbanness (with the exception of the large city category). The concluding note of the study is, therefore, left upon the question of how important are the regional and urbanness categories shown in the eight cross-classification cells in Tables 26-39. If they are meaningful in themselves, then the findings demonstrated in Parts II and III are modified considerably. It is obvious that further inquiry is needed in this matter. It could be that many of the individual cross-classification cells in Tables 26-39 have high school populations which are too small for meaningful analysis.

It is important that this study be viewed only as an important first step towards a complete analysis of the Project Talent high schools. A model was built, performance measures were examined, and the relationship of some of those measures to expenditure and size has been examined. In the next step, individual characteristics of the high schools should be examined in more detail. Unfortunately, this will probably require a great deal of expense, although there is a doctoral dissertation completed at the University of Pittsburgh (which the author has not seen at the time of writing) which extends the analysis somewhat farther in this direction.[53] It is almost certain, however, that more intensive analysis of these high schools cannot be undertaken by an economist, or any other researcher or group of researchers in a single discipline, working alone. Such work will of necessity require interdisciplinary team efforts by members of educational research institutes, by that name or some other, if the research is to be conducted in the depth and degree of sophistication that the subject deserves.

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[53] Bernard H. Booms, "Empirical Estimates of Secondary Education Production Functions," Unpublished Doctoral Dissertation, University of Pittsburgh, 1968.

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ABSTRACT

This is a study of the relationship of public high school performance to expenditure per pupil and high school size. The data used were generated by the American Institute for Research (Project Talent) for 775 public high schools in the continental United States. An attempt was made to evaluate 12 potential measures of high school performance. What were judged to be the most important of the output measures were related to high school expenditure and size in a simple model of the educational process in which performance of pupils from similar socio-economic backgrounds is explained by a general intelligence factor score, school expenditure, school size, and an index of pupil socio-economic background.

When all the public high schools were considered together, it was found that expenditure was significantly related to performance with $100 of expenditure typically being associated with between one and two-tenths of a standard deviation of the output variable. Also for all high schools, it was found that increased size was negatively related to most measures of performance. With respect to pupils from different home environments, it was found that school expenditure is related more consistently to the performance of children from better socio-economic environments.

The study also analyzes in great detail the differences in the performance of the variables in the model relative to regional and urbanness characteristics. The results for within groups of high schools cross-classified by both region and urbanness was that there seemed to be little relationship of expenditure and size to performance. At a slightly higher level of aggregation, however, relationships similar to those for all schools taken together were found.

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